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THE SCOTTISH GEOGRAPHICAL MAGAZINE

THE SCOTTISH GEOGRAPHICAL MAGAZINE

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THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

SKETCH OF THE HISTORY OF TELEGRAPHIC COMMUNICATION BETWEEN THE UNITED KINGDOM AND INDIA.

(*Read at Meeting of Society, 13th December* 1888.)

By General Sir R. Murdoch Smith, K.C.M.G.

To the present generation, the telegraphs to India and the Far East on the one side, and to America on the other, seem as commonplace as those which connect the different cities of the United Kingdom. Early failures are long since forgotten, and we accept the marvellous abridgment of space with which we are now familiar as the most natural thing in the world, as a sort of spontaneous growth or outcome of the spirit of the nineteenth century. Success, however, preceded as it was by costly failures, was only achieved by dint of persistent personal efforts, by individuals most of whom have already passed away. I propose on the present occasion to give a short account of those efforts, and of the difficulties which had to be overcome in the case of the telegraphic system between the United Kingdom and India. I confine myself to this particular system for several reasons. Of all the great inter-continental telegraphs, that which connects us with India is the most important for the general interests of the Empire. This would be the case even if India alone were concerned, but its importance is vastly enhanced by the fact that upon it also depends our communication with the Straits Settlements, the Australian Colonies, China, and Japan. Secondly, the telegraph to India was the first of the great inter-continental telegraphs, in point of time, to be successfully established. Lastly, through the accident of my connection with it from its first beginning until quite recently, I happen to be familiar with its history.

The first idea of connecting England with India by telegraph began to take shape during the great crisis of the Mutiny thirty-one years ago, when the necessity for such means of communication had become painfully

manifest. By the most rapid means then in existence it took nearly three months to get answers to communications passing between London and Calcutta—a time more than sufficient for the loss of an empire.

The line chosen for the projected telegraph was naturally that of the Overland Route. This involved the laying of long submarine cables in the Mediterranean, the Red Sea, and the Indian Ocean. The failure of the first Atlantic cable had, however, so disheartened the public that submarine cables were regarded as investments of too hazardous a nature to be undertaken by prudent people without special guarantees. Unaided private enterprise could consequently not be expected to undertake the great risk of a telegraph line to India, more especially of the portions in the Red Sea and the Indian Ocean. In the Mediterranean a beginning had already been made by a private company whose cable from Marseilles to Malta it was hoped would be extended to Alexandria. Following the system adopted in the case of the Indian railways, the Red Sea portion was constructed and laid in 1859, with a Government guarantee of 5 per cent, shared equally between the Imperial and the Indian Treasuries. The cable, however, had barely fulfilled the conditions required by the terms of the guarantee when it collapsed, leaving the British and Indian Exchequers burdened until the present day, and for some years yet to come, with an annual payment of £18,000 each. Shortly afterwards, viz. in 1861, the Mediterranean Company laid a short-lived cable from Malta *viâ* Tripoli and Benghazi to Alexandria.

Warned by the costly failure of the Red Sea route, the Government of India turned their attention to the Persian Gulf. With the aid of the British detachment, who had charge of the telegraphs established in Turkey for military purposes during the Crimean war, the Turkish Government had shortly before this time erected a line from Constantinople across Asia Minor and down the valley of the Tigris to Baghdad. This line, it was thought, might by arrangement with the Turkish Government, be extended to the head of the Persian Gulf, and a cable be laid thence to the most western point which could practically be reached from India by a land line along the coast of Beluchistan. Negotiations were accordingly opened at Constantinople with a view to the accomplishment of this project, and a careful survey of the bottom of the Persian Gulf was ordered to be made. The general direction of the scheme was placed in the hands of the late Colonel Patrick Stewart, R.E., C.B., a most distinguished officer, who had already given signal proof of remarkable energy and capacity while in charge of the field telegraphs during the Sepoy war. The negotiations at Constantinople resulted after some time in a convention which provided for the erection, with British assistance, of a line from Baghdad *viâ* Busreh to Fao, at the mouth of the Shat el Arab or united Tigris and Euphrates. Colonel (now Sir) Frederic Goldsmid, then Collector of Karachi, was instructed to proceed along the coast of Beluchistan to ascertain the exact political condition of each district, and to make arrangements by subsidies or otherwise, with the local chiefs for the protection of the proposed land line. This task—thanks to tact and diplomatic skill—he successfully accomplished, and in accordance with his report it was decided to construct a line from

Karachi along the Mekran coast (as this part of Beluchistan is generally called) as far west as Gwadur, a fishing village in the occupation of the Sultan of Muscat. The gap from that point to Fao it was decided to fill up by means of a submarine cable, to be manufactured and laid at the expense of the Indian Government, without the intervention of a guaranteed private company.

The project therefore at this time (1862) stood as follows :—1st, The lines as they then existed between London and Constantinople; 2d, a Turkish line already opened between Constantinople and Baghdad; 3d, a line to be made with British help from Baghdad to Fao; 4th, a submarine cable to be laid from Fao to Gwadur; and 5th, a land line to be erected from Gwadur to Karachi. From London to Constantinople there was no special organisation for the transmission of international traffic. Each State had its own system adapted to suit its own internal requirements. From Constantinople to Fao the Turkish Government retained the entire charge and working of the line in their own hands. From London to the head of the Persian Gulf messages would consequently have to undergo most varied treatment, and be transmitted by clerks of many nationalities, all totally unacquainted with the language in which the telegrams were written. It was hoped that when through communication was once opened the different Governments concerned would be induced to give special facilities for the transit of Indian messages. One of the sections, however, above enumerated—that, namely, in Turkish Arabia, from Baghdad to Fao—was thought likely to prove very unsafe, and liable to constant interruption at the hands of the lawless Arab tribes of Mesopotamia. It was therefore deemed advisable to open negotiations at the Court of Teheran with a view to obtaining an alternative line between the Persian Gulf and Baghdad through Persia. The negotiations, however, seemed very unpromising, and not likely to lead to any practical result.

Such were the projects and prospects (not very bright it must be confessed) of telegraphic communication with India when Colonel Patrick Stewart assumed general charge of the scheme in 1862. Accompanied by Major (afterwards Sir John) Bateman Champain, R.E., he went to Persia for the purpose of examining the country from a telegraphic point of view, and of ascertaining what prospect there was of a satisfactory arrangement being made with the Persian Government, without which all idea of a line through that country was, of course, out of the question. The situation of the principal cities in Persia, which it was presumed the Persian Government would naturally wish to connect with the capital, Teheran, by means of the proposed telegraph, at once indicated the route which the line should follow, viz., Bushire, Shiraz, Ispahan, Teheran, Hamadan, Kermanshah, Baghdad, a distance of about 1300 miles. On reaching Teheran, however, Colonel Stewart found there was little prospect of a practicable telegraph convention being agreed to. The Persian ministers were naturally somewhat suspicious of our motives and objects, and made all kinds of impracticable proposals in order, as was supposed, to delay or defeat the scheme we were pressing on their attention. Their policy appeared so clearly to be what in parliamentary language would now be called

"obstruction," that Colonel Stewart determined to go straight to London to push on the main and original portions of the project, viz. the Baghdad-Fao land line, the Fao-Gwadur submarine cable, and the Gwadur-Karachi land line, leaving Major Champain to go over the Teheran-Baghdad route, and then follow him to London.

The Convention with Turkey having by this time been signed, steps were at once taken to get the manufacture of the Fao-Gwadur cable begun, and the materials prepared for the Baghdad-Fao and Gwadur-Karachi land lines. When these operations were approaching completion, news was unexpectedly received of the signature of a Telegraph Convention at Teheran, which revived the all but abandoned project of an alternative line through Persia. As the main line through Turkey ultimately fell into practical abeyance, and the Persian line became the main channel of communication, it is of some interest to recall the terms of this first Persian Telegraph Convention. The idea of *our* erecting and working a line in Persia was by it entirely set aside. On the other hand Persia undertook, on our providing the wire and insulators (the cost of which she was to repay by instalments), to make and work a line herself from Bushire *viâ* Teheran to Baghdad, and to allow us, at a tariff to be fixed afterwards, to have our Indian messages transmitted by its means. The only intervention on our part provided for by the Convention was the presence of *one* English officer for a limited period in Persia to *advise* as to the best method of construction. Unpromising as such a Convention was, it was decided to take action on it, in the hope that something more practical might therefrom be ultimately evolved.

By the middle of 1863 the manufacture of the cable had been all but completed; the sailing vessels in which it was to be conveyed to the Persian Gulf had been chartered and fitted for its reception; the Mekran coast land line had been fairly begun; and the materials for the Mesopotamian and Persian land lines had been got ready for shipment. The staff of the various sections had also been appointed—some in England, some in India—and all started for their several destinations before the end of the year.

The year 1864 was almost entirely spent in construction work on the different sections. The cable was successfully laid in the spring the whole way from Fao to Karachi, with intermediate stations at Bushire, Mussendom, and Gwadur, the portion east of Gwadur having been added to the original scheme as an alternative to the Mekran coast land line. The process of laying the cable was not so simple a matter as such operations have now become. The Suez Canal had not yet come into existence, and the cable had consequently to be conveyed round the Cape of Good Hope in sailing vessels, which, during the actual laying of the cable, were towed by steamers of the old Indian Navy; the Karachi-Gwadur land line was completed; and the necessary buildings for the accommodation of the staff were erected or adapted at the different stations in Beluchistan, at Mussendom, at Bushire, and at Fao. The Baghdad-Fao line was completed in the course of the year, so that the project of a telegraph from London to India had by the end of 1864 become an accomplished fact. But there are telegraphs and telegraphs.

and a vast amount of work had yet to be done before anything like regularity or efficiency was attained in the parts of the system not under the direct control of the Indian Government. Strange as it may appear, it was in Europe that by far the greatest difficulties existed. The lines east of Constantinople—partly, no doubt, through the smallness of the local traffic—were far more satisfactory than those to the westward. To devise and urge on the most necessary ameliorations, Colonel Stewart hurried to Constantinople as soon as the Persian Gulf cable had been laid. There, owing to the general injury to his constitution caused by the unsparing manner in which he had for years overworked himself, he succumbed to an attack of fever in January 1865. Colonel Goldsmid, with whom was associated Major Champain, succeeded him as Director-in-Chief of what had now come to be designated the Indo-European Telegraph Department, and I succeeded Major Champain as Director of the Persian section, assisted by Captain (now Colonel Sir Oliver) St. John, and the late Captain Pierson, both of the Royal Engineers, and by a detachment of twelve, afterwards increased to twenty-four, non-commissioned officers of the corps. Our position had from our first landing at Bushire, in the end of 1863, been extremely anomalous, as it will be remembered that the Convention with Persia provided for no such executive staff, but only for the presence of *one* English officer, with no executive functions whatever.

It will probably, however, give a clearer idea of the subsequent history of the telegraph if I here break the chronological order of the narrative, and for a few minutes call your attention to the main physical features of Persia and the general condition of the country at the time of our arrival.

Physically, Persia may be described as a great plateau, overlooking the Caspian Sea on the north, the plains of Mesopotamia on the west, and the Persian Gulf on the south. To the north-west and to the east the plateau extends into the Armenian provinces of Turkey and Russia on the one side and into Afghanistan on the other. To reach the plateau, the plains of which are at an average elevation of 4000 to 5000 feet above the level of the sea, great mountain barriers must be surmounted, no matter from what side the approach is made. On the side of the Caspian, this barrier consists of a range of mountains known in Europe as the chain of the Elburz—a name, however, which in Persia is applied only to one particular mass of it near Teheran. On the side of the valley of the Tigris and the Persian Gulf, range after range running in a general N.W. and S.E. direction, has to be crossed before the main plateau is reached. The table-land itself is intersected by numerous ranges and detached masses of mountains, except in Eastern Persia, where great plains are the main feature. With the single exception of the provinces which lie between Elburz and the Caspian, the climate is remarkably dry. Throughout the summer little or no rain falls, there are few rivers other than mere freshets in spring-time, and most of the agriculture is carried on by artificial irrigation, which depends chiefly for its supplies on the melting of the winter snows. The temperature of the plateau is what one would expect to find

it under those conditions in the latitude of Persia, viz., very hot and dry in the summer, very cold and snowy in the winter, and temperate in spring and autumn. In the more elevated districts, and especially in the mountain passes, several of which our telegraph crosses at an elevation of 8000 feet above the level of the sea, the cold in winter is excessive, and the snow often such as to render all locomotion utterly impossible. The hardships, and even the dangers, attending a journey in the mountainous parts of Persia in winter, can hardly be realised by those who have not undergone them; and winter is, unfortunately, the season when the telegraph lines are most liable to damage and interruption, and when consequently such journeys have most frequently to be undertaken by those who have charge of the maintenance of the lines.

There were no carriageable roads, and wheeled vehicles were practically unknown. The roads were merely mule tracks. Merchandise was carried on the backs of camels, mules, and donkeys, and the personal baggage of travellers almost exclusively on mules. Of those useful animals and of horses there was an abundant supply of excellent quality at very moderate prices. Accommodation for caravans was to be found on most of the main roads at caravanserais, from 25 to 30 miles apart, at most of which fodder for the animals was procurable. This, however, was by no means universally the case, and at many of the caravanserais nothing but the rude shelter of the bare walls and a meagre supply of brackish water was obtainable. For all his personal wants the traveller had to carry his own supplies with him. Owing to the want of means of communication, the local governors were all but uncontrolled by the Central Government at Teheran. Each governor, so long as he held office, was supreme, even in matters of life and death, within his own province, and practically did what seemed good in his own eyes. Leaving the towns out of account, the country population consisted of about equal numbers of sedentary cultivators or *rayats*, and nomadic pastoral tribes or *Eeliauts*. The latter are a very independent and somewhat turbulent set of people. They are well armed and well mounted, and their property, consisting as it does of tents, flocks, and herds, is altogether movable. During a great part of the year, they frequent the most mountainous and inaccessible parts of the country. No wonder, therefore, that, like the highland rovers of our own country in former days, they are apt to regard robbery as a fairly legitimate means of supplying their wants and improving their lot. Under such conditions it was not surprising that the roads should sometimes have been infested by armed bands of robbers, who had as little scruple in taking the lives as in helping themselves to the property of those who were unfortunate enough to fall in their way. The state of a province depended in this respect almost entirely on the character of the Governor. If, like most of his countrymen, he was a man of energy and determination, the roads were wonderfully safe, while if he was a man of weak or indolent disposition, murders and robberies were of constant occurrence. Under the former class of governors robbers were unsparingly hunted down and summarily executed—sometimes, it must be confessed, in a cruel or barbarous manner. Governors of this kind were at

least a terror to evildoers, if not always, or to the same degree, a praise and protection to them that did well.

There is an institution in Persia which even the most cursory account cannot pass without notice—the *chapar* or horse-post, which has probably been handed down to the present time with but little change from the days of Xerxes and Darius. Post-houses or rather post-stables, containing relays of saddle horses, are kept up at distances varying from 20 to 30 miles apart all along the main roads radiating from the capital to the extremities of the kingdom. As a rule the horses are good. A traveller who is accustomed to hard riding, and not afraid of fatigue, can by means of the *chapar* get over the country at the rate of 80 to 100 miles a day. He must, of course, sleep on the ground, and content himself with the barest modicum in the way of kit and provisions. *Chapar* is the express train of Persia, and I need hardly say that we found it extremely serviceable, and used it freely. I regard it with much respect, and I have probably had more experience of this thoroughly Persian institution than any other European, having chapared an aggregate distance of fully 25,000 miles. The fact that I should have done so without molestation, travelling as I did without escort, by day and by night, at all seasons of the year, speaks volumes for the good order which generally prevailed. Sometimes, it is true, I narrowly escaped, and all of our staff were not so fortunate as myself, several of them having been robbed and wounded, and two of them killed.

The Persians are a decidedly robust, handsome race, amply endowed with the gifts of intelligence and imagination. They are of a restless, active disposition, and in this and many other respects totally unlike what Orientals are supposed to be. Grasping and unscrupulous in the pursuit of gain, they are free and even lavish in their expenditure. The rich love to surround themselves with all that is beautiful. They live in spacious houses luxuriously and tastefully furnished. Their love of fine gardens with long vistas of flowers, shrubs, trees, and fountains, amounts almost to a passion. "Live and let live" is one of the practical mottoes of their lives. A rich man is almost invariably surrounded by a host of retainers and dependants who, with their families, live on his bounty. An acquaintance with the works of their great poets is very general. More than once, at a Persian gentleman's table, I have heard a guest either prompted to an apt quotation or corrected in a false one by one of the servants in attendance. The untruthfulness with which they are so constantly credited, is not altogether vicious. Much of it is little more than a form of politeness which ceases to deceive those who are familiar with their ways. Their ever active imagination accounts for as much more of it, as well as for the poetic and artistic instincts by which they are so eminently distinguished.

But to resume our narrative. In the course of the year 1864, a single wire line from Bushire *viâ* Teheran to the Turkish frontier, near Baghdad, had been erected on wooden posts supplied by the Persian Government. This was accomplished with the greatest difficulty, owing to the opposition of some of the local governors, who, naturally, regarded with dislike a new-fangled Feringhi invention which could not fail, in

the end, to diminish their powers and privileges. Before the line was completed, 200 miles of it, over the most difficult part of the country had been entirely swept away by the Eeliauts at the secret instigation of the local authorities. The Convention, as was to be expected, had proved of little practical value, as it barely furnished a valid excuse for our presence in the country. After much negotiation, a second Convention was signed, which provided for our management of the line for five months, at the expiry of which period we were to hand it over to Persian officials, and at once leave the country. By the end of that time, however, in 1865, the opposition to our presence had much subsided, and towards the end of the year a Convention for five years was negotiated and signed. In 1866-67 a second wire was added, to be used exclusively for Indian traffic. The protection of the line and its prompt repair in cases of interruption were our great difficulties. For the latter, the system, finally adopted after several others had failed, was as follows: At towns or villages, or other suitable places, 50 to 80 miles apart, control stations were established, each of them in charge of a European clerk with two Persian gholams or horsemen, who had been thoroughly trained as linesmen. At stated hours the clerks placed their instruments in circuit and at once saw if everything was all right. If anything was wrong the fault was at once localised, and a gholam despatched from each of the control stations, on either side of the fault, with orders to ride rapidly along the line until he had reached and repaired the fault, and until he had met the gholam coming from the other station. As the gholams provided their own horses they had a direct interest in keeping their sections in good order so as to diminish, as much as possible, the frequency of the rapid journeys which they had to make.

It will be remembered that communication had been opened, *viâ* Baghdad in the end of 1864. A stream of telegrams at once poured in daily. But the want of efficiency in the lines across Europe and Asiatic Turkey, to which I have already referred, caused great delay and confusion in their transmission. This was only aggravated when, in 1866, the Russian and Persian Governments joined their local lines at the Perso-Caucasian frontier and announced to the commercial world that a new route for Indo-European messages had been established *viâ* Russia. On neither the Russian line nor the local Persian one, under Persian *employés*, from the frontier to Teheran, was there a staff in any way competent to deal with international English telegrams. The state of confusion in which the messages reached or did not reach their destinations was something appalling. Delay and mutilation were bad enough, but what was perhaps still worse was the hopeless confusion of dates. A message (dated say the 1st of the month) might, as probably as not, be overtaken and passed on the road by a message to the same place dated the 2nd, 3rd, or 4th. A merchant at Calcutta or Bombay might, by a happy accident, get a telegram giving him the London prices of the day before, while his neighbour's latest, received at the same time, might be a week or ten days old. This intolerable state of things led the eminent engineering firm of Siemens Bros., at the head of which was the late President of the Royal Society, Sir William Siemens, to conceive the idea

of a special through line from London to Teheran, to be made and worked by an English company for the transmission of Indo-European messages alone. The firm had large branches in Berlin, St. Petersburg, and Tiflis, where they were well and favourably known by the German and Russian Governments. This fact, no doubt, facilitated their obtaining, as they did in 1867, concessions from those Governments to construct and work a line, on certain conditions, across Germany and Russia, exclusively for messages to and from India. A similar concession was obtained from Persia for the section between the Russian frontier and Teheran. An English company, called the Indo-European Telegraph Co., was then formed to take over the concessions and carry them into effect. With as little delay as possible, work was begun, and in the spring of 1870, an excellent specially constructed line, with two conductors, worked throughout by English clerks, was opened for traffic between London and Teheran, where it joined our Government lines, to which I have already referred.

While the Indo-European Company's lines were being constructed another company was formed in London for the purpose of laying a submarine line the whole way from England to India. Like the Indo-European Company, the Eastern was called into being by the hopeless state of confusion in the existing lines west of Teheran and the head of the Persian Gulf. Had the communication over those lines been better than it was, possibly neither the Indo-European nor the Eastern Company would have come into existence. In this case good arose from, and was due to, excess of evil. Submarine telegraphy had, since the former failure of the Red Sea route, made enormous strides, thanks chiefly to the brilliant and eminently practical genius of our distinguished conntryman, Sir Wm. Thomson. The result justified the confidence of the founders of the Eastern Company in the success of their scheme, and almost simultaneously with the opening of the Indo-European Company's line to Teheran came the opening of the Eastern Company's to Bombay. From that time to the present day, a period of nearly nineteen years, telegraphic communication with India has been regular, rapid, and unintermittent. Had either of the companies been established *alone* in 1870, the other would possibly, perhaps probably, never have come into existence. As it is, Government and the public have the great advantage and the great security of two entirely different telegraphic systems uniting the Indian Empire with the metropolis, viz., the Indo-European *viâ* Lowestoft, Emden, Berlin, Warsaw, Odessa, Kertch, Tiflis, Teheran, Bushire, and Karachi; and the Eastern with two cables *viâ* Falmouth, Gibraltar, Malta, Suez, Aden, and Bombay. To these must be added the original route through Baghdad and Constantinople.

To bring the history down to the present day, but little remains to be said. The Mekran coast land line was, many years ago, extended to Jashk, near the mouth of the Persian Gulf, to which place also was transferred the submarine cable station formerly at Mussendom on the opposite Arab coast. From Jashk to Bushire a second cable has existed for the last twenty years.

In Persia iron standards were substituted throughout for the old

wooden poles, the constant renewal of which in a comparatively treeless country was a perpetual source of trouble, anxiety, and expense. Our Convention and the Indo-European Company's concession have both been modified and their term extended for a lengthened period of years.

A whole lecture might be devoted to the history of the regulation of international telegraphy, the necessity for which became gradually apparent to all the States of Europe. In the framing and revising of these regulations at the periodical international conferences, the late Director-in-Chief of the Indo-European Telegraph Department, Colonel Sir John Bateman-Champain, took a conspicuous and eminently useful part. But this, as well as the question of tariffs, is too large and complicated a subject to be more than hinted at on the present occasion.

Of the efficiency attained by the telegraphic service between this country and India, you may judge for yourselves by the few following facts:—Some considerable time after through-communication had been opened, a hope was expressed (in 1867, to the best of my memory) that the service might eventually be so improved that telegrams would reach their destination correctly and regularly within a maximum of *three days* from their original dates. This opinion, however, was thought at the time to be too Utopian. Messages between all parts of the United Kingdom and all parts of India (not merely those between London and the Presidency towns) *now* reach their destinations within an average interval between their reception at one end and their delivery at the other, of less than an hour and a half. In an average of only one word in about two hundred does even the most trivial mistake occur in transmission. And it must be remembered that the telegrams are almost entirely either in code or cipher, which, as compared with ordinary language, adds enormously to the chances of error, as well as to the time required for transmission. Were this degree of speed and accuracy attained with a small amount of traffic, it would still, I think, bear favourable comparison with that of any telegraph system in the world. But the traffic to which those averages apply amounts to the large total of nearly 1000 messages a day.

Of the far-reaching effects which this constant stream of rapid communication has had, and has, on the Government, the commerce, and the general condition of India, I shall not attempt to form an estimate. One effect on this country is patent to all, viz., the greater and more widely-spread knowledge of India, and the greater interest taken in her affairs. Every noteworthy event is at once telegraphed to the press at home, and in every Monday's copy of the *Times* appears an exhaustive summary of the week's Indian news accompanied by such commentary as the events seem to call for. It may perhaps surprise you to be told that those interesting telegrams are altogether unpadded, and that even to the punctuation—the use of inverted commas for instance—they are printed absolutely *verbatim*.

The effect of our telegraph in Persia has been very considerable. By it, and by the numerous other lines of which it has been the parent, the powers of the local governors have been much curtailed and brought

directly under the control of the Shah and his Ministers at Teheran. Oppression has thereby certainly diminished. By means of the telegraph Persia has been brought practically within the community of European States. She now has regular diplomatic relations by means of embassies and legations with Great Britain, Russia, Turkey, France, Germany, Austria, Italy, and the United States of America. A regular postal system has been organised, with a bi-weekly post to Europe, and a weekly one from Teheran to India and all parts of Persia. A participator from the beginning in the International Telegraph Convention for the regulation of international telegraphy, Persia has for a good many years been also a member of the Postal Union. A beginning has been made in the construction of carriageable roads in the neighbourhood of Teheran, where also a short railway six miles in length has recently been opened. As announced by the Prime Minister at the Mansion-house, the Shah has this year opened to the navigation of all countries the only navigable river in his dominions, the Karun, an affluent of the Shat el Arab, into which it flows near the town of Mohammerah. These and many other signs of progress that could be enumerated are in great measure due to the successful establishment and maintenance of our telegraph in Persia during the last twenty-five years, and more especially to the good relations which have so long subsisted between our telegraph staff and all ranks and classes of the people.

While thus attributing to the Telegraph a large share in the improved Government and slow but steady progress of Persia during the last quarter of a century, it would be altogether misleading and unjust if I inferred that it was the sole, or even the principal, cause of the forward movement that is going on. That cause must be sought for in the high intelligence of the Persian people, and in the liberal and patriotic spirit of the Sovereign who has ruled over the land for the last forty years.

It is, I think, worthy of record that the long and constant intercourse between our telegraph staff and all sorts and conditions of men in Persia, instead of begetting, as it might easily have done, mutual aversion and ill-will, has had the very opposite effect. For many years the relations of our staff with the Persians of all classes have been of the most friendly character. When you remember that our English staff, numbering fifty or sixty individuals, is scattered all over the country, along a line of 1300 miles, many absolutely alone so far as other Europeans are concerned, and all brought by the nature of their duties into constant contact with the rulers and people of the country, I think you will agree with me that the friendly feelings and mutual good offices which prevail are highly creditable to English and Persians alike. We have always endeavoured to act on the principle of conducting ourselves towards the Persians, in social as well as business matters, as if they were our fellow-countrymen, and they have certainly responded in a generous and hospitable manner. Speaking personally, I am happy to count among them some of my best friends, and I look back with pleasure on my long residence of over twenty years in their country, in whose independence and welfare I shall always take the deepest interest.

JOURNEY IN THE VICE-CONSULAR DISTRICT OF CHIENGMAI.

By W. J. Archer, H.M. Acting Vice-Consul, Chiengmai.[1]

A report which appeared in a recent Parliamentary paper, by Mr. W. J. Archer, a specially well-informed and intelligent Consular officer, of a journey in the vice-consular district of Chiengmai, contains curious information both as to the character and resources, and the social condition, of a region hitherto very little known to Europeans. Perhaps the most striking point brought out in the narrative is the exceeding sparseness of population over great areas of land which, if not actually fertile, is at all events capable of great development. In some parts the remains of former cultivation, or of ancient civilisation and prosperity, show that this sparseness is due to the ravages of former wars either among themselves, or with Burma or Siam, which were usually followed either by wholesale slaughter or wholesale deportations. The estimate formed by Mr. Archer of the population in the parts visited by him incline us to adopt a much lower estimate for the entire population of Siam than that usually given in the Siamese official returns; and in this connection it seems strange that the Chinese immigrants who are to be found in large numbers not only in Bangkok, but on the alluvial tracts above the city, have not been attracted to these upper regions.

Considerable activity, however, is observable throughout this Lao country; towns are being rebuilt, and settlements formed, mostly, indeed, by means of involuntary and forced migration, which, whatever the ultimate results, are attended by much present hardship. While speaking of the province of Müang Fāng, the author describes the process of a new settlement. Müang Fāng, it may be mentioned, is situated on a tributary of the Mekong, the great river of Cambodia. Its capital was destroyed by the Burmese in the last century, and subsequently deserted; upwards of 300 ruined temples have been counted, and there are large tracts of fertile and cultivable land: yet the present population of the whole province is probably under 2000. It is, however, slowly increasing.

"This new capital was founded nine years ago, and has still the peculiar appearance of a new settlement. It is interesting to notice how these settlements are effected by the Laos, as it may illustrate the manner in which the present capitals of these states were founded within comparatively recent times. The site generally chosen for the future capital is close to, or on the banks of, the principal river, and it is of primary importance that the surrounding country should be a fertile plain well suitable to rice cultivation. The capitals of these provinces are, therefore, almost always situated in the midst of a flat, low country, but on ground sufficiently elevated to secure them from high floods. In the case of Müang Fāng, however, the city lies at the foot of the hills on the Mē Chan, and

[1] Abstracted from Parliamentary Paper *Siam*, No. 2, 1888.

at a little distance from the Mē Fāng; this position was probably chosen in order to avoid the too heavy inundations of this river. Where the new settlement is on the site of a former city, the old embankment or wall, if any such remain, is kept as the boundary of the new town, and, in time, a wooden palisade, perhaps about 12 feet high, is put up; later, if the new city has greater pretensions, this is replaced by a high brick wall, either entirely, as in the case of Nan, or partly, as in Chiengmai and Lakhon. The site having been fixed upon, the laborious task of clearing the jungle is begun; all, or nearly all, the trees are felled, the roads are marked out, and alongside the settlers are allowed to choose a piece of ground. A rough shanty is generally put up at first, and round it are planted bananas and other quick-growing plants; the grounds of the old temples are not encroached upon, and the principal "wats" are often re-occupied by priests. Many of the new-comers first reside in the capital, but, as by degrees they have opportunities of becoming better acquainted with the surrounding country, they begin by cultivating the most promising land in the neighbourhood; others join them, and thus villages are founded, and when a longer residence and increased population have given a feeling of greater confidence and security, settlements are gradually formed further from the capital. A large body of immigrants, or a number of families from the same locality, generally form a separate settlement, especially if they are of different race from the original settlers: and if they settle in the capital they usually have a separate quarter allotted to them.

"This is characteristic of all the settlements in Siam, both in the larger cities and in the provinces. In Bangkok the inhabitants of the different quarters have gradually become amalgamated, but not far from the capital the colonies of former captives of war still retain their language and customs, and keep up little intercourse with their conquerors. In the northern country the separation is as complete, and the town of Chiengmai, for instance, is divided into numerous quarters, inhabited almost exclusively by people of a different race; and many of the villages in the provinces are also colonies of refugees or captives."

Again, the country about Chiengsēn, formerly an important city, on the banks of the Me Khong, is described as "a vast expanse of deserted rice fields now covered with high grass and stunted trees that testifies to the former flourishing state of the province. There is here no jungle to clear, and probably but little labour would be required to bring the greater part of the plain to its former state of cultivation; but as yet settlers are few, and the deer and tigers are left undisturbed. The plain is bounded on the east by the Nam Khōng, and beyond it is a mountainous country, inhabited only by hill tribes, though a few Lao settlers have recently ventured there; that it still abounds with wild game is shown by the fact that on my arrival in Chiengsēn I was greeted by the roar of a tiger from the bank opposite the city.

"The appearance of the broad and deep Cambodia River, or Nam Khōng, as it is called here, is particularly striking to one accustomed to the other comparatively small waterways of Siam. Unfortunately, the rapids which are said to obstruct the navigation of this magnificent river

form a serious check to the commercial development of an immense country, possessing, no doubt, great natural resources. . . . The city of Chiengsën is situated on the right bank of the Nam Khōng, and close to some low hills at the south-east corner of the plain. The site of the old city of the same name has been chosen for the capital of the new Lao settlement. The space formerly enclosed by the wall is probably as large as that of Chiengmai; but, as yet, only a very small portion of it is occupied at all; the rest is a dense mass of rank vegetation that covers even the ruins of the numerous temples which attest to the former greatness of the city. A stockade is now being erected on the old enceinte, but wild beasts still roam at night amongst the ruins. This place, formerly a dependency of Burma, was taken and destroyed by the Laos about the year 1804. It is said that the white-bellied[1] Laos of Luang Phrabang and Wieng Chan joined their black-bellied[2] brethren of Chiengmai and the other Western States in the expedition against the city; on the other hand, Chiengmai claims to have effected the conquest with only 1500 men. Such of the inhabitants as were not massacred or were unable to escape were carried off captives, and allowed to settle in the heart of the Lao country, mostly on the plain of Chiengmai.

"The present Lao settlement was begun about six years ago; a number of the descendants of the old inhabitants have been sent back to resettle the country, and a representative of the former rulers of Chiengsën has been appointed Governor. In addition to these, settlers have been drawn from nearly all the western Lao provinces. The hardships which these poor people have to undergo during the first years of their settlement are so severe, that few of them have emigrated to the province of their own free will, though the absence of all tax farms in the frontier settlements is no small inducement to emigration from the older provinces. The Governor of Chiengsën informed me that about a third of the immigrants have died since the foundation of the colony. The privations the early settlers had to suffer probably increased the mortality, but fever was doubtless engendered by clearing the rank vegetation, and will lose much of its virulence when the country is better occupied. . . .

"Whilst at Müang Phān I witnessed another phase in the formation of settlements in this country. The chief of Chiengsën having received permission to establish in his province a number of the inhabitants of Müang Phān, proceeded, in the language of the country, to drive the people into the new colony. However sound may be this policy of migration, it was impossible not to commiserate the unfortunate people who were thus driven from a comfortable home into a bare, uncultivated country, where it would cost them many years of struggle to recover only a portion of their former prosperity. Unable to dispose at so short a notice of their houses, their gardens, and fertile rice-fields, they were compelled to abandon everything that could not be easily transported. I met many of these families, some carrying their children, or perhaps the domestic fowl, in their arms, and some such few household goods as they were able to remove.

[1] *i.e.* not tattooed. [2] *i.e.* tattooed.

"Müang Phān, as well as the district under Phayāo directly to the south, is populous, and appears indeed to enjoy greater prosperity than most of the surrounding country. It is well irrigated, and the crops are generally good, while many of the other common necessaries of life are here abundant and cheap. Fish is indeed very plentiful in the extensive lake, or rather marsh, that occupies the centre of the plain, and it forms an important article of export, giving rise to a considerable trade with all the neighbouring States."

Yet Müang Fāng was itself deserted during the early part of this century, and only re-peopled from Lamphun about fifty years ago. Chienghai, in the lower valley of the Mekhok, has also a new capital, but it is forty years old, and to the traveller coming from the new unformed settlements, its "numerous gardens, neat roads, and well-built houses have a most pleasing aspect." Chienghai may some day become commercially important from its position on the road from Yunnan and Chiengtung southwards, and also on the route between Chiengmai and Luang Prabang. Mr. Archer, describing the proposed railway through northern Siam, says :—

"If the railroad were made to pass through Chiengmai, the great mass of mountains between this city and Chienghai would probably prove a serious difficulty. But if it were to follow the valleys of the Mënam and Më Wang as far as Lakhon there would appear to be no great natural difficulties to overcome, and thence north-eastward to Müang Ngāo, the road would lie over easy undulating country. From Müang Ngāo to Phayāo the watershed of the Mënam and Nam Khōng must be crossed, but it is of no very great elevation, and, I believe, would not present any serious difficulties. Once this range is passed, the whole way to Chiengsën, and some distance further northward, is on almost quite level ground, apparently highly suitable to a railway. This route is, I think, preferable not only because it offers great natural facilities, but because a large portion of the country traversed is capable of great development, and it is evident that the advantages of a railway to these States are based not on the actual wealth, but on the consequent commercial development of the country."

Perhaps the most interesting part of Mr. Archer's route was his journey to Nan, the most eastern of the Lāo States, through a country rarely, if ever, traversed before by a European. Between Müang Suet and Nan is a wild mountainous tract abounding in large game, as elephants and tigers. The town of Nan is situated in the centre of the broad valley of the eastern branch of the Mënam. Having less intercourse with Siam, it retains many laws and customs which have fallen into disuse among the western Laos. Its criminal code is very severe.

"The punishment for theft and robbery is death, and as it is often applied, the province enjoys a most enviable immunity from crime, and its people a very wide reputation for honesty. Capital punishment is not so commonly applied in the more western States, and more often the less effective, but more profitable, punishment is adopted of seizing also the family of the criminal, and reducing them all to slavery, as well as confiscating their property.

"Müang Nan also enjoys complete exemption from all the tax farms

that are so burdensome in other provinces; but there is the customary rice tax, which is here still paid in kind, and of course Government service. Not many of the people of Nan find therefore any inducement for leaving their country, nor do they intermarry to a great extent with the people of Chiengmai or Lakhon. It is indeed strange to notice what little intercourse there is between these States, and what profound ignorance prevails in Chiengmai with regard to Müang Nan.

"The people of Nan are no doubt a far purer race than that of Chiengmai, and, it struck me, are handsomer, though of darker complexion. It would indeed be hardly correct to judge of the Lao race by the people of Chiengmai, for the constant intercourse with their neighbours, the Burmese and Shans, has no doubt greatly modified the original type. Some peculiarities of pronunciation are common to Nan, Phrë, and Lakhon, but there is closer connection between the two former. Though the language is radically the same in Nan and Chiengmai, there is, however, considerable difference between the two provinces in tone and idiom.

"In dress it appears probable that Müang Nan has preserved the customs once common to all the Laos. With regard to the men, the usual clothing is so scanty that it hardly admits of any modification, but on formal occasions the headmen wear a red turban and silk jacket. In Chiengmai the latter has been replaced by the white jacket copied by the Siamese from Europeans. The "sins," or petticoats of the women, however, are, in Nan, of a distinctly different and, I think, more tasteful pattern. They also wear thick silver bracelets not very different from those of the Ngios in Chiengsën, and their hair is tied in a knot not so low back as in Chiengmai.

"With regard to the peculiarities of costume and of the manner of dressing the hair, which distinguish the Lao women from the Siamese and both Lao and Siamese men from the Shans, the following explanation given me may, if correct, draw closer the connection between the Siamese and the more northern branches of the Thai family. It is said that the "sin" of the Laos was formerly also worn by the Siamese women, but that on the occasion of an invasion of Lower Siam by the Burmese it was ordered, in order to facilitate their escape, that the Siamese women should wear clothes similar to those of the men; and gradually this dress became established amongst them. It is, indeed, curious that the style of dress of the Siamese women should differ from that of all their neighbours, the Malays, Annamites, Laos, and Burmese. Again, it is said that the Siamese formerly wore their hair long and tied up in a knot like the Shans, but that at the time of the wars between the Siamese and Burmese, or Peguans, in the sixteenth century, orders were given that the Siamese should cut their hair close, to distinguish them from their enemies.

"Müang Nan enjoys a good climate, and especially in the valley of the Nam Nan; the rains are plentiful, and the crop is hardly ever known to fail. Salt is abundant, but of somewhat inferior quality, and it is said that there is also iron and gold in the province. Some precious stones are found not far to the west of the capital, which are supposed to have specific virtues, and are therefore jealously guarded, but which would probably have no value in a European market. Elephants are numerous,

and hunts on a somewhat large scale are occasionally undertaken; when sold, part of the proceeds go to the catcher and trainer, and part to the Government.

"The walled city of Nan itself is smaller than Chiengmai, and bears much resemblance, both in shape and dimensions, to the little city of Lamphun. It contains almost exclusively the residences of the chiefs and a few temples, but the greater part of the inhabitants reside at Wieng Kāo, a large suburb about a mile to the north, occupying about half the area enclosed by a rectangular palisade that is now almost entirely decayed. This was the former capital, and was abandoned about thirty years ago, because the location was not found propitious. This superstition, evidently of Chinese origin, is no doubt the reason that capitals of Indo-China are so often removed. Any personal misfortune or unsuccess induces the ruler to seek what is supposed to be a more favourable site; for the same reason all the official residences in Lakhon have been removed from the north to the south bank. The capital of the province is said to have been formerly further south; but some of the temples near the city appear to be ancient. The account given of the foundation of Wat Changkam, the principal temple in the city, is common also to other temples in the country. When the city was besieged by the Burmese, or by Hōs, a compact was made that whichever side should first raise a "phrachedi" or pagoda of a certain height should be considered the victors. The invaders began to build one of brick, which is unfinished to this day; but the Laos, with the aid of an elephant, were soon able to raise a high mound of the required height of baskets of sand, on the top of which they fixed the umbrella, and the enemy, taking it for granted that they were the losers, retreated. The name, "Wat Changkham," denotes that the temple owed its foundation to the assistance of an elephant."

The return journey towards Lakhon lay through Müang Ngao, an important sub-province of Lakhon, with numerous and populous villages, and a general appearance of prosperity and animation. The broad valley is well cultivated, with rich rice fields, and there are extensive teak forests which have been leased to a British company. Mr. Archer was struck with the scarcity of teak, so far at least as his observations extended, in the valley of the Me Khong, compared with the amount he saw after crossing the watershed into the Menam basin; but he adds that it is impossible to speak with confidence on the subject in the absence of a more thorough survey. He testifies warmly to the cordial reception given him everywhere by the local authorities, and to the friendly disposition of the people.

The work of the settlements above described seems to be materially aided by the labour of the various aboriginal tribes, many of them of other than Lao extraction, who inhabit the mountainous regions of Northern Siam, and are glad to supply their various wants by working for wages. Buddhism seems never to have reached these tribes; their only religion, or superstition, a dread of evil spirits everywhere present and needing propitiation, forms also practically the important part of the creed of the more ignorant among the Siamese Buddhists. Among these bands

of labourers, however, there is one whose name is of historical interest. They come from a district tributary to China, on the extreme north of the Shan country, on the upper waters of the Salwin, and are considered good and hardy labourers, and likely to be employed by us on public works in Upper Burma. They are called by the Laos "Thai Yai," *apropos* of which name it may not be out of place to say a few words in explanation of the various names Thai, Shans, Ngios, Laos, and Siamese, which are applied, sometimes in a confusing manner, to the different branches of the race which occupies the greater part of the Indo-Chinese peninsula. All these branches, we believe, without exception apply to themselves the name Thai, which means "free;" the term "Shan" is used only by the Burmese, being apparently a Burmese, or rather l'eguan, translation of Thai, and possibly a kindred word (compare Ahom=Assam, and Sam, the Assamese equivalent to Shan; also Sien-lo, the Chinese name for Siam). The Shans were formerly a powerful kingdom or confederacy: their influence, which culminated about the fourteenth or fifteenth century, extended from the country on the Upper Salwin, about 26° N., to the southern extremity of the peninsula, and was felt even in Java. The Siamese, indeed, while speaking of themselves as Thai noi, *i.e.* "little Thai," call the Shans Thai yai, *i.e.* "great Thai," perhaps from having preceded them in their supremacy over the region now known as Siam.[1] It is specially interesting to find a "Thai yai" tribe in the extreme north of the Shan region, because this was precisely the site of the headquarters of the great Shan Confederacy, known as Ko Shan Pyi, *i.e.* "the nine Shan States" (a punning version of the Indian name Kaushambi), and called Muang Mau, from the name of its most prominent member. The term *Ngio* is local, and applied to some of the northern tribes of the Salwin valley formerly subject to Burma, and now semi-independent. The term *Lao* is applied by the Siamese to the Shans, who are under their sovereignty, but the latter do not use, and according to Mr. Archer, do not like the term, and apply it only to the "white-bellied" (*i.e.* not tattooed) inhabitants of the basin of the Me Khong, to the east of Müang Nan. C. T.

THE INLAND ICE OF GREENLAND.[2]

From the latest Danish Investigations. By H. Rink.

(Translated from the German by W. A. Taylor.)

The results of the scientific explorations, carried on in Greenland since 1876 by the Danish Government, at the instigation of Professor Johnstrup, have from time to time been communicated to those interested in Arctic geography through various periodicals. A general survey of the investigations that have been made, particularly with regard to the formation of glaciers and to the inland ice (by which is meant the icy

[1] See *Encycl. Brit.*, arts. "Shan" and "Siam."

[2] *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, vol. 23, No. 5.

covering supposed to extend all over the interior of the main-land), may be welcome at the present time, seeing that one principal branch of these inquiries may be said to have been brought to a conclusion in 1887. It will be remembered that such an extension of the land ice as described above was considered to be an established fact by most, though certainly not all, Arctic authorities. The possibility of the existence, in the interior, of valleys free from ice and of a somewhat more luxuriant vegetation has indeed been discussed up to a quite recent date. But the origin of icebergs, the question by what means masses of ice more than 1000 feet thick can find their way from the land into deep sea, has given rise to divers theories, involving also the question, whether the so-called inland ice is, after all, different in character from ordinary glaciers. The same provisional answer has been given by all the researches instituted during a survey of the most northerly trading district on the West Coast. For the question whether the outer edge of the inland ice is continuous may be looked upon as settled as regards the coast examined by our travellers—that is, up to nearly 75° N. lat. on the west and 67° N. lat. on the east. It seems almost evident that, if such be the case—if this wall of ice leaves no opening free, through which rain water can reach the sea—on this ground alone valleys free from ice below the level of the wall can hardly be conceived to exist in the southern half of Greenland. Such depressions must, at any rate, take the form of lakes.

In the first place, as regards this outer limit of the inland ice, all the members of the expeditions have more or less assisted in determining its position, for this wall was also the natural landward boundary of the territory they had to survey and explore. The travellers, who in the last eleven years have gone out to explore the coast of Greenland, of which a distinctly defined section was assigned to each expedition, and the tracts they visited, are as follows:—K. J. V. Steenstrup (naturalist), with G. Holm (naval officer), and Kornerup (naturalist), traversed the district of Julianshaab (60°-61° N. lat.) in 1876; in 1877, with A. Jensen (naval officer), the Frederikshaab district (61°-62½° N. lat.) In 1878, Steenstrup journeyed to North Greenland, where he spent two winters. In the same year Jensen, with Kornerup and Groth (draughtsman), travelled over the Frederikshaab and Godthaab districts (62°-64° N. lat.) In 1879 Jensen, with Kornerup and R. Hammer (naval officer), inspected the coast from 67°-68½°, after which Hammer passed the winter there. The summer of 1880 found Steenstrup and Hammer in North Greenland, while G. Holm, Groth, and Petersen (naturalist) continued the exploration of the southern promontory of Greenland. In 1881, Holm, with Sylow (naturalist), visited again the country round Cape Farewell. In 1883, Hammer, Sylow, and Larsen (naval officer) traversed the coast from 67°-70° N. lat. Holm, W. Garde (naval officer), and Knutsen and Eberlin (naturalists) undertook the journey to the East Coast, which lasted till 1885, and necessitated the establishment of winter quarters twice. Meanwhile Jensen, in 1884, followed the coast from 65¼°-67° N. lat., with Rüss-Carstensen (painter), while, at the same time, a cruise of the man-of-war *Fylla* was utilised for scientific purposes. In 1885, Jensen, Ryder (naval officer) and S. Hansen (anthropologist) traversed the coast from 64½°-65½° N. lat. Lastly, in 1886, Ryder, Block (naval

officer), and Ussing (naturalist) went to Upernivik (72½°-75° N. lat.). where the first two spent the winter, and the *Fylla* visited Davis Strait a second time.

If we assume that Greenland does not extend much further towards the north-east than the coast already known, and therefore may consider its northern boundary as lying, on the whole, between the extreme known points, Cape Kane[1] (83½° N. lat.) on the west, and Cape Bismarck (76½° N. lat.) on the east, the perimeter of Greenland may be estimated at 3600 nautical miles, if the line be taken through the extremities of the promontories. If, however, the line be drawn through the inner extremities of the fiords, cutting off the whole outer fringe of islands and peninsulas, the length of the perimeter will amount to 3200 miles, or thereabouts. The line will then be the boundary of the region we wish to denote as the inland region, and, it may be added, that it also coincides, on the whole, with the edge of the inland ice. As many as 1400 miles, or almost the half of these 3200 miles, have been sufficiently explored by the above-named expeditions, in order to determine whether the interior is icebound along the whole extent. Where ice was not actually observed, its presence was conclusively proved, partly from the appearance of icebergs proceeding from the interior, partly by information given by the inhabitants. Besides these inquiries and the mapping of the edge of the ice, the ice itself was occasionally climbed, and the exploration carried further into the interior. To the investigations on this subject must be added those carried out contemporaneously by foreigners, namely, by Nordenskiöld in 1883, and by Peary and his Danish companion, Maigaard, in 1886; both these expeditions, as is well known, penetrated further into the interior than any former traveller had done.

The result of all these researches is that, as has indeed been generally supposed, the edge of the ice is continuous, and all hope of discovering inhabitable land within it must be abandoned. On the contrary, whenever an incursion into the interior was attempted, it was found that the surface, instead of falling and rising to form valleys, rose continuously, and grew flatter and more uniform the further the traveller advanced. The ice also was covered with snow. Our travellers also climbed the high mountains of the coast more frequently than previous explorers: everywhere the interior presented the aspect with which we are acquainted through earlier descriptions of Greenland, namely, a boundless snow-covered plateau, above which here and there a very few solitary peaks rose like islands from a sea. Owing to this appearance of the surface, an opinion was formerly held that the interior of Greenland was a uniform plateau. But now, when the same phenomena have been observed on all parts of the long coast-line of Greenland, and there is little probability of the existence of a flat uniform table-land of such extraordinary extent, the question arises whether the horizontality may not be due to a levelling down of the surface by the glacial covering. The snow must, in such case, have passed at a slight depth into ice

[1] Cape Washington lies to the north-east of Cape Kane, *vide* Greeley's Address, vol. i. p. 605.—Ed.

which has filled all the hollows of the country. This theory is in harmony with the properties of glacier ice, which, in spite of its brittleness, behaves like a viscous fluid, only that its movements are exceedingly slow. If an ordinary glacier can not only slide down over its bed like a rigid body, but also flow like a cohesive paste, it is also possible that, if it attains the necessary dimensions, or unites with other glaciers, it may, on arriving at the foot of the mountain, spread itself out over the lower terrain. In other words, the movements of the immense mantle of ice, as now more accurately determined, confirm the fact that the inland ice of Greenland may be compared to a flood descending from the watershed of the interior.

Observations all tend to prove that, in proportion as new ice is formed in the inland districts, a propulsion of the older ice towards the edge of the field takes place. The consequences of this would be a general advance of the edge towards the sea, and the spread of the ice over the coast, were it not that the heights form a barrier against the inundations of the ice in some parts, and that elsewhere the movement of the edge is very variable. As a rule, this movement is only just sufficient to make good the loss caused by the thawing of the terminal surface in the summer heat of the coast, so that the edge, though advancing and retiring periodically, maintains the same mean position. Only sharply defined sections, the offshoots which descend from the edge into the so-called ice-fiords, are subject to a movement considerable enough to overcome the effects of this thaw, so that they force their way into the sea, where their extremities are broken off and carried away. Such outlets are certainly few and at long intervals, but their local energy is so much the greater, and the notion of an inundation alone—that is, the flow of ice from the most distant regions of a large continent—can explain the production of the immense mass of ice which the ice-fiords employ in the formation of icebergs. Before we examine this phenomenon, the formation of icebergs, more closely, let us first turn our attention to the structure of the surface of the ice.

Where the edge of the ice has low open land in front of it, it presents, as a rule, the appearance of a mighty stream of lava suddenly arrested and turned rigid. Then it rises in a steep, riven, and furrowed wall. If one succeeds in surmounting this wall, one finds that the surface ascends considerably up to an average height of 2000 feet. It is almost needless to mention that, in representing this surface as a level plateau, we take no account of certain inequalities, occurring even in this first tract, and only clearly perceptible at a short distance. Here crevasses, several hundred, or perhaps even a thousand, feet deep, constantly impede the progress of the wanderer, and inspire him with awe. The bluish colour of the walls which skirt these abysms disappears into the complete darkness of the fathomless depth below. Smaller fissures may be hidden under a covering of loose snow. Others are old, their edges have fallen in, and they are partly filled up; so that it is very tiring work to cross these channels and the ridges which separate them. Other irregularities of the ground are indistinctly marked terraces, shallow pools, and, lastly, foaming brooks, which speed along their icy beds until they pour in cascades over the sides of crevasses, and disappear.

Seen from a distance, these inequalities vanish, and do not at all alter the general level aspect of the country. It is the universal rule, that the rise of the ground is continuous; the inclination may vary at different points of the coast, but towards the interior it constantly decreases, as also do the inequalities of the surface, so that at length the snow lies before the traveller on an even surface of scarcely perceptible declivity. The greatest height which has been reached in this region may be estimated at 7000 to 8000 feet. The increasing frequency of crevasses as the coast is approached is evidently due to the unevenness of the ground and to the twofold nature of ice, in which the properties of a solid mass and of a viscous fluid are combined. At the watershed far away in the interior, where the conversion of snow into glacier ice takes place, its movement is guided chiefly by the laws of fluids; but the further it progresses towards the coast the greater the pressure which the hinder parts exert as rigid bodies on those in front. The water formed on the surface, which flows into the crevasses, may also exert an influence but slightly noticeable in ordinary glaciers. It is proved that the channels in the depths of the ice, in which this water collects and flows to the sea, alter in form. It may be that the streams, being dammed up, flow into new channels, where they freeze, and considerably increase the tension of the whole mass. All the influences that act on the ice are concentrated at the ice-fiords, where the motion caused by pressure becomes so overpowering that the ice is almost entirely urged forwards as a rigid mass, and its fluid properties have no time to produce a visible effect.

Along the stretch of 1400 nautical miles, mentioned above, the sea touches descending branches of the inland ice in numerous places. As a rule the movement of these branches is so slight, that the fragments (*calf* ice) launched into the sea scarcely deserve the name of icebergs. Only twenty-five or thirty of these branches produce real icebergs, so that the land-locked bays which receive them may be termed ice-fiords. These ice-fiords also vary considerably as regards the effects produced in them. We have accordingly divided them into classes. In the first and most important only six to eight fiords must be placed. Four of these, and one belonging to the second rank, have now been carefully examined. The land-ice which descends into these fiords has the appearance of an ordinary glacier, inasmuch as it is bounded on both sides by land. But from most mountain summits it is at once apparent that it proceeds from the great "Mer de glace" in the background. The depth of the sheet of ice, which is thus forced onwards, cannot indeed be measured directly, but it must be equal to the shortest diameter of the larger icebergs. The breadth from land to land may be measured, and, lastly, the velocity has been determined for points in a transverse line, and it has been shown that the velocity is greatest in the middle, and decreases towards the sides. The velocities of the same glacier at different seasons have also been partly determined. During this work, fluctuations have been discovered, of which the nature and cause remain completely unknown. Perhaps they may be due to the alteration above mentioned in the channels within the ice.

The measurements taken prove that the middle portions of all these

glaciers, at the period of their quickest motion, have an average velocity of 51 feet in twenty-four hours, or a little over 2 feet per hour. By means of these calculations of the dimensions we may arrive at a notion of the average magnitude of the mass, which is yearly detached from each of these glaciers and floated out to sea. Placed on dry land, it would form a mountain 14,000 feet long, 13,000 feet broad, and 900, or perhaps, even 1000 feet high, and would therefore contain a volume of 170,000 millions of cubic feet.

It can scarcely be doubted, in presence of such measurements, that these ice-fiords imply the existence of large areas corresponding to the river basins of other countries, from which they draw their supplies of ice, even from the most remote parts of the interior. We must remember that no glacier ice can move at all over land without being accompanied in the course of the year by a quantity of water several times as large, and we know from experience that streams do actually flow into the fiords beneath the ice. Then it must be borne in mind that this mass of ice, 1000 feet thick, is propelled over a bottom, which has but an insignificant inclination for the bed of a solid sliding mass. Whence, then, is the power drawn which forces it onward at the rate of 2 feet per hour? We must look for it in the concentration on single points, the ice-fiords, of the combined pressures of glacier masses, starting probably in the interior at an elevation of over 10,000 feet. Attempts have been made to account for the velocity and productivity of these iceberg-forming glaciers by a great inclination of the underlying ground close to the fiords. But this is contradicted by actual experience, and, besides, the question presents itself, how the supply, thus rapidly consumed, can be replaced from the immediate vicinity of the fiord. If, however, it can be conveyed from a distance, it does not require a bed specially adapted for the purpose to glide down the last part of its course.

Granted, then, that the region required to feed an ice-fiord may be compared to a river basin proportional in extent to the country, a glance at the map will show at once, that in North Greenland it is by no means improbable that fallen snow and rain may traverse in a solid state a distance of 400 nautical miles from the furthest point before reaching the sea. Accordingly, the process of ice-formation in that country may be applied to illustrate the glacial period of geologists. The transport of erratic blocks over low-lying land of great extent and the polishing of rocky slopes which lie below a certain level, find their counterparts in the phenomena which must be produced there. In the propulsion of a mantle of ice, certainly more than 1000 feet deep, over uneven ground, the projecting points and ridges of the latter must be broken off and reduced to a powerful polishing powder. A comparison of Greenland with the other known Polar lands will at once prove that in the former country only can be found such a counterpart to the glacial period.

With regard to the way in which icebergs become detached from the solid mass—the "calving," as it is called—different opinions have hitherto been held by experts. The reason is not so much that only one observer has been fortunate enough to witness this magnificent spectacle, but that the process varies with the locality. It is affected by the form of the

coast and the structure of the sea bottom at the spot, where the glacier happens to have found an outlet, and therefore a fixed rule cannot be laid down. This much only may be said, that, where large icebergs are produced, the block remaining whole and not crumbling up into smaller pieces on breaking loose from the glacier, the sea-bottom must be comparatively even and slope gently from the coast, until the water becomes deep enough to raise the great sheet of ice from the bottom. It then forms a connected floating pier, until some accident breaks the connection. If, however, the sea-bottom falls suddenly to a considerable depth, before the ice can be raised from the ground, the sheet of ice splits up as it falls into pieces larger or smaller, according as they receive more or less support from the water. In this case the sheet breaks more like a frozen sea, for the severance is not effected directly by the force of gravity, but, on the contrary, the smaller fragments are violently swung round, so that their edges and points are turned upwards, and overtop the edge from which they have fallen. Of course the bottom of the sea, which determines the mode in which icebergs are formed, can hardly be examined at all. But, it must also be remembered, this question is at present of secondary importance in physical geography. The first question is, How large is the total quantity of ice yearly discharged from a fiord, irrespective of the larger or smaller dimensions of the fragments?

It may be expedient to pass from these general considerations to some particular cases. Let us, then, follow the observations of the individual expeditions from east to west.

The East Coast up to 66° 8′ N. lat. was traversed (1884-5) by Holm, Knutsen, Garde, and Eberlin. The two former wintered in Angmagsalik (65° 37′ N. lat.), while the other two did not get much further than 63°, but between them they travelled over the coast, from this point southwards, twice backwards and forwards in the two years, and therefore had a good opportunity of noting carefully the occurrence of glaciers and icebergs. It seems, from what is known of the most northern parts of East Greenland, that north of 70° N. lat. few icebergs are produced compared to those of the West Coast. These icebergs are said to drift from this latitude southwards along the coast. According to the observations made on the *Germania* (73°-77° N. lat.), indeed, and, in particular, the reports of the well-known journey over the pack made by the shipwrecked crew of the *Hansa*, the number of glaciers increases considerably towards the south. This is especially noticeable before the entrance of Scoresby Sound (70°), which is probably an ice-fiord. The inquiries of our East Coast expedition among the natives revealed the probable existence of a large ice-fiord at 68°. Between this and Cape Farewell the expedition discovered five ice-fiords. The icebergs get stranded one after another, and are disintegrated, few reaching Cape Farewell, and hardly any entering the open sea to the south-east. The East Coast at this part is more inhospitable and covered with ice and snow than the West Coast in the same latitudes. Only about 63° (Tingmiarmut) and 65½° are there fiords having stretches of low land covered with vegetation, such as are seen on the West Coast. According to Garde, up to 63° and a little beyond, no fewer than seventy glaciers 1600 mètres (1750 yards) broad, and more than one hundred

smaller glaciers were found, all terminating in the sea, of which more than one-half were prolongations of the inland ice. Here, too, the ice-bergs were piled up along the coast in extraordinary numbers, the largest of them being about 260 feet high.

Steenstrup and Holm have explored and described the southern part of the West Coast as far as 62° N. lat. The southern promontory is formed of a tableland which, in this direction, confines the inland ice like a dam. It has mountain peaks 5000 to 7000 feet high (those in the distance are probably 8000 to 10,000 feet), between which lie numerous isolated glaciers, in some places touching the inland ice, so that the limits of the latter cannot be clearly defined. It can be unmistakably recognised in two small ice-fiords at latitudes 61° and 61½°. One much more extensive is to be found at 61¾° (Narsalik). On the whole, the East Coast, up to 68°, seems to produce fewer icebergs than the corresponding part of the West Coast.

Between 62° and 68½° the edge of the inland ice is almost stationary for a remarkably long distance. Except at Godthaab (64°), only one or two fiords of quite insignificant productivity occur. On this part of the coast is to be found the largest extent of low-lying land unencumbered by ice, and, formerly, it was seldom or never visited, except by natives when hunting reindeer. The whole area measures about 400 nautical miles from north to south, and generally 48 to 80 from east to west. We have to thank Captain Jensen and his companions, named above, for having performed the troublesome task of measuring this district. Here the longest known fiords of Greenland are to be found, and yet, long as they are, they often do not reach the inland ice, from which they receive the largest rivers of the country, if indeed they can be called rivers. The sources of these streams rush forth from caves, often magnificent vaulted galleries, in the rampart of ice. Where the ice encircling the isolated mountain groups spreads itself in huge streams over the lower country, signs frequently appear of periodical advance and retreat. In the former case abundant vegetation extends up to the edge of the ice, whereas in the latter case stones and rubbish have been left behind by it on receding. The soil, too, is thrown up into moraines, as though by an enormous snow-plough, and the rock is crushed into splinters. In other places the ice has closed outlets and formed lakes, which have dried up again on its retreat. Large patches also are seen of new land composed of glacier mud, in which vegetation spreads itself but slowly owing to the loose sand.

Jensen, Kornerup, and Groth proposed to investigate more closely the feebler motion here alluded to by making an excursion on the ice towards the interior at 62½° N. lat. The "Frederikshaabs Eisblink"[1] here forms a continuation to the inland ice, the edge of which is separated from the sea only by a narrow strip of low sandy ground. During more than 100 years, passers-by have gazed at it without ever noticing any important change. This projecting tongue, bounded by high ground on both sides, is about 20 nautical miles broad and six long up to its junction with the inland ice. From this last point the travellers forced their way 16 miles further, as far as Jensen's *nunataks*. The whole

[1] Eisblink = edge of inland ice.—Ed.

surface of ice thus examined is about 480 nautical square miles, and has about ten other *nunataks* besides the one just mentioned. This area is provided with fresh ice chiefly by the interior, while the old, towards the strand, melts away in the warmer air. The most distant *nunataks* rise from ice 4000 feet above the sea, and attain an additional height of 1000 to 1500 feet. Their further sides give a notion of the violence with which the ice advancing from the interior dashes against these rocks, set up like palisades to check its progress. Forced high up against the sides, its fragments fall like cascades upon the level surface previously mentioned. Here the whole is reduced to a level, though intersected by numerous crevasses, and winds like a stream between the other *nunataks* to the coast. As early as the middle of July the front part, up to an elevation of 2500 feet, and forming more than the fourth part of the whole plain, was free of snow. Considering, then, the amount of heat available during the summer to act on the ice thus exposed, it is easy to perceive how it has come to pass that the outer edge of the ice has kept the same position in spite of the strong impulse from the rear.

We come at last to the true home of icebergs, the coast between 68½° and 75° N. lat., which contains all the large ice-fiords on the western side that are thoroughly known. The most southerly, the Jacobshavn Fiord, has been most minutely explored, and the observations extend over many years. The last were made by Hammer, who wintered at Jakobshavn, and has published a monograph on this remarkable locality. Here also the first measurements of glacier motion have been taken (by A. Helland), and here, too, the calving of a large iceberg was witnessed for the first and only time. Finally, in this fiord, the floating condition of the outermost part of the glacier was most clearly demonstrated. It has, for instance, been proved that its edge is pushed a mile further forward in some years than in others. This outer part is changeable in character also, and at different times may be split up by chance causes, and converted into detached icebergs. The icebergs which are launched forth from this fiord are seldom less than 300 feet high; one that was measured was found to be 403 feet, while the edge from which it had fallen away was only 200 feet high. The depth of the glacier in the centre probably amounts to considerably over 1000 feet. The breadth is 14,000 feet, and the middle part moves in July 63½ feet in 24 hours (Helland, 1875). About 4000 feet nearer the side the speed in March and April (Hammer, 1880), was 33 to 51½ feet. The declivity of the whole glacier was only ½°. With regard to the irregular occurrence of *calving*, it must be remembered that the original cohesion of the mass may be very different: as long as it moves through a narrow part of the valley or fiord it is held together by the pressure of the sides, but this support is lost where the fiord opens out.

The examination of the next section, from 69¾° to 72½°, was the work of Steenstrup. In this is situated the large Umanak Fiord, which branches out into seven or eight ice-fiords. In its neighbourhood the same discoverer has collected a rich treasure in other branches of geology. We must here confine ourselves to giving the measurements he made in three of the fiords.

The Torsukatak glacier is 25,000 feet broad, and the velocity at some distance from the centre is 16-25 feet in 24 hours (according to Helland 29,000 feet broad; velocity in the centre 30-32 feet).

The Karajat glacier has a breadth of 19,000 to 22,000 feet and a velocity of 22-38 feet.

The Itivdliarsuk glacier has a breadth of 17,500 feet, and a velocity of 46 feet in April, 21-28 feet in May.

We have now arrived at the last field of investigation. It extends up to 75° N. lat. (the last camp of our travellers was at 74½°). Inhabitants in communication with the Danish emporiums are not found beyond this point, and no communication is known to exist between the natives here and those of Smith Sound. The exploration of this territory was carried out by Ryder, Block, and Ussing, as was mentioned before. The two former spent two summers over this work, wintering in the most northern colony, Upernivik. In the southern part of this district lies a comparatively large area unencumbered by ice, but further north such ground is almost entirely restricted to the larger islands and a few headlands, which shoot out from between the arms of the inland ice. The most remarkable spot is the Bay of Augpadlartok, the central inlet of which forms an extensive ice-fiord. The branch of the inland ice, which there descends into the sea, has the highest rate of velocity ever observed in a glacier, namely, 100 feet in 24 hours, or over 4 feet an hour. A measurement at about the same point gave only 34 feet per day in April. The icebergs in this fiord were of no great height, and even the highest (about 200 feet) did not seem to rise above the terminal wall of the glacier. To judge from the map, about 15 glaciers were observed proceeding from the inland ice in the north of this bay, some of which produce large numbers of icebergs.

We know but little of the behaviour of the inland ice beyond this limit of the territory explored by our expeditions. It is, however, supposed that the coast exhibits the same features as far as Cape York, and that huge icebergs sail out of Melville Bay also. This, however, is doubtful as regards the region north of 76°. The extraordinary difficulties encountered in penetrating into Smith's Sound are, it is well known, due to floes, not icebergs. It is even doubtful, whether the noted Humboldt glacier is exceptionally productive of icebergs, and still further north, as far as I have been able to ascertain, their occurrence entirely ceases. Taking into account what has been already stated with regard to the East Coast, it would seem, that the West Coast between 68°½ and 76° N. lat. is most prolific in icebergs, and that the majority of these, that pass over to Newfoundland, and thence wander over the Atlantic Ocean, must originate in this region. The great breadth of the northern half of Greenland renders this intelligible, especially if the tableland, observed by the second German North Pole Expedition and accessible from Franz Joseph's Fiord, marks the watershed, and, as has been supposed, lies a third of the distance from the East to the West Coast.

If the opinion stated in the foregoing pages concerning the inland ice is correct, it is easy to answer the question, whether it really differs from the icy mantle of a mountain in the temperate zone, except in magnitude

or extent. No doubt it may be looked upon as a further development of a system of glaciers, such as flow down the flanks of one of these mountains. These glaciers spread themselves over the low-lying land, but there they have at the same time expanded and united, so as to assume the form of an inundation, though in their under parts they remain divided owing to the influence of their original watersheds, and indicate their condition by amazingly large differences of velocity at the common outer edge. In order to continue the comparison, one must picture to one's-self, on the one hand, a large mountain glacier with the snow field on the mountain summits, which feeds it, and on the other a glacier giving off large icebergs in connection with a part of the interior, which serves it as a river basin. Then it must be remembered that the former glacier fails to satisfy the conditions of this comparison. It may fairly be assumed that an ordinary mountain glacier consists of three parts, of which the first and uppermost is continually forming fresh ice out of snow, the middle part retains its volume unchanged during its progress, and the lowest is constantly diminishing owing to melting, which, at last, places a limit to the further progress of its extremity. Compared with such a glacier, the arm of the inland ice, which gives off icebergs, corresponds only to the foremost end of the middle division, if this be broken off over the verge of an abyss. To compare it with an ordinary glacier in its entirety, the Greenland glacier must be supposed to extend over level ground, and there be dissolved by summer heat, instead of breaking off in the deep water of an ice-fiord and floating away. The primary origin of the inland ice also has been, probably, somewhat different from its present continuous formation. First of all, mountain glaciers have checked the flow of rivers, and these may, by long-continued floods during the winter, have added to the quantity of ice, so that the increased elevation of the whole constantly became more favourable to the congelation of snow.

In conclusion, it may be added incidentally that numerous proofs collected by the expeditions indicate that at an earlier period the inland ice covered also the greater part of the coast land, islands, and peninsulas now bare. The marks it has left behind are erratic blocks and rocky slopes, polished and furrowed up to a certain height, above which mountain peaks rose like islands, just as the *nunataks* do now.

OBITUARY, 1888.

Brazza, Jacques de.—Jacques de Brazza, a brother of the distinguished Governor-General of the Congo French Territory, died on the 1st of March last at Rome. In 1883 he went out to West Africa as a member of the mission of which his brother was the chief; he distinguished himself by his scientific observations and, above all, by his exploration of the river Likwala, which settled definitely the disputed question regarding the Licona. On returning from his voyage he brought with him an ethnographical collection which is now exhibited in the Paris museum. Shortly before his death, the Italian Geographical Society had

voted 100,000 *lire* for the expenses of a new expedition to the Congo, which was to have been placed under his command.

GREGORY, THE HONOURABLE J. T., whose name figures very conspicuously in the annals of Australian exploration and colonisation, died at Harlaxaton, in Queensland, on the 24th of October last. He was the son of Captain Joshua Gregory, of the 78th Highlanders, who, in 1829, went out with his sons to settle in Western Australia. Young Gregory engaged early in the work of exploration, and in 1846 he headed an expedition into the country lying to the east and north of the Swan River, which has since become the seat of a most flourishing colony. In 1857 he was requested by the Home Government to take command of the expedition commissioned to explore the northern coast of the island, with a view to ascertain whether the land in that quarter was suitable for the growing of cotton. In the course of this tour he discovered the pearl-fisheries, which have since developed into a great and lucrative industry along the north and north-west coasts. He discovered also the Ashburton and Fortescue rivers, and thus opened up for settlement the rich pastoral lands through which these streams find their way to Cambridge Gulf. He next turned his attention to the geology of Western Australia, and was the first scientific authority who pointed out that the colony contained gold-fields which could be remuneratively worked. He went afterwards to Queensland, where he settled down for the rest of his life. Here he held successively the posts of Assessing Commissioner, Crown Lands Commissioner, and Postmaster-General, and he was for many years a member of the Legislative Council. The Royal Geographical Society showed its appreciation of his merits as an explorer by awarding to him its gold medal. He was a man universally respected, and his name will always be associated with the early history of the colonisation of Australia.

JOHNSTON, SIR WILLIAM.—By the death of Sir William Johnston, which took place on the 7th of February last at his residence near Gorebridge, Edinburgh has lost one of her citizens whose name was widely known throughout the world. He was the son of an Edinburgh merchant, and was born on the 27th of October, 1802. After being educated at the Edinburgh High School, he entered the printing-office of Mr. W. H. Lizars, as a clerk, and thereafter he and his brother, the late Dr. Keith Johnston, established themselves in business as printers and map-engravers. With what great ability, enterprise, and success this business was conducted, is known to all. The maps and other publications of the firm enjoy a world-wide reputation. In 1848, Mr. Johnston, who had for many years previously taken an active part in municipal affairs, was unanimously elected Lord Provost of Edinburgh, and this position he held with acceptance till 1851. One of the most notable events that signalised his tenure of office, was the laying of the foundation-stone of the National Gallery at the foot of the Mound—a ceremony which was performed by H.R.H. the late Prince Consort. Mr. Johnston received the honour of Knighthood, in Holyrood, from Her Majesty in 1851, and shortly afterwards withdrew from public life.

KERR, W. MONTAGU.—To the roll of our enterprising countrymen who have fallen victims to their zeal in the cause of African discovery, the year just closed has added the name of Walter Montagu Kerr, who died at Hyères on the 27th of April last, from the effects of a fever contracted in East Africa. He was born at Perth in 1852, and was the son of Lord Charles Lennox Kerr, and cousin of the present Secretary of State for Scotland—the Marquis of Lothian. After being educated at the Charterhouse School, he learned engineering and began the practice of that profession under Sir Thomas Bouch, then engaged in constructing the Tay Bridge of unfortunate memory. He went thereafter to California and then to Mexico, where, under the pressure of very trying work connected with mines, of which he had been appointed surveyor, his health broke down. He returned to England to recruit, and then settled down in New York in pursuit of a business on the Stock Exchange, which proved lucrative. His health, however, again gave way, and, finding that visits to England failed to restore it, he turned his thoughts to Africa, sold his business at a loss, and in the autumn of 1883 sailed from England for the Cape of Good Hope. From the moment of his arrival he seems to have been fired with an enthusiasm for exploration. Under its prompting he undertook, single-handed, that daring and perilous journey of which he has given so interesting a narrative in his work entitled "In the Far Interior." On this journey, which commenced at the Cape, he made his way through the Orange Free State, Matabele and Mashona Lands, across the Zambesi to Lake Nyassa and down to Quilimane. His observations have made some additions of value to our knowledge of the geography of the regions through which he passed. Mr. Kerr, after returning to England and revisiting Mexico, partly on business and partly for health, turned his thoughts once more to the "Dark Continent." His first design was to go unaccompanied to Khartum in order, among other objects, to recover, if possible, Colonel Gordon's journals. Finding, however, that this project was quite impracticable, owing to the opposition of the authorities at Suakim, he resolved to make his way to Emin Pasha's station at Wadelai, and explore thence in any direction that promised the best results. To carry out this plan he proceeded, in November 1887, to Zanzibar, where he organised his expedition. From Zanzibar he crossed over to Mombasa, and thence advanced into the interior. Two days, however, after starting he was seized with such a violent fever that he was carried back to the coast and sent on to Cairo. The climate of this place proving unsuitable, he removed to Marseilles and then to Hyères. Here, though he rallied for a time, he succumbed at last to the effects of the fever, aggravated by the depression of spirit resulting from the disappointment of his hopes. He is deeply lamented by all with whom he had, at any period of his life, been associated.

MACLAY, NIKOLAUS VON MIKLUCHO-.—This famous Russian explorer and anthropologist died last year in St. Petersburg at the age of 42 years. Accounts differ as to his birthplace—some assigning it to a village in the government of Novgorod, others to the Ukraine. It is

agreed, however, that he was of aristocratic parentage. He studied medicine and the natural sciences, first at St. Petersburg and then at certain German universities. In 1866 he accompanied Professor Haeckel to Madeira. In 1867 he visited the Canary Islands, and in 1869 Marocco. He then began to make preparations for a voyage of exploration to the Pacific Islands, and especially to New Guinea. He went to his destination in the Russian corvette *Vitias* by way of South America, Waihu, Mangareva, Tahiti, Samoa, Rotumah, and New Zealand, and passing through the Vitias Strait, which separates Rook Island from that part of New Guinea now called the Maclay Coast, he entered Astrolabe Bay and anchored at Port Constantine, a small haven on its south-east side. Towards the end of the voyage he saw the high mountains called subsequently by Moresby "Finisterre," and named the two highest peaks "Kant" and "Schopenhauer," respectively. He remained on the north-east coast of the island for about a year, after which he explored the south-west coast as far as to the southward of Geelvink Bay. In 1874-75 he visited India and then Malacca, where he explored in the interior and made a series of valuable observations. After having visited the Pelew, Admiralty, and other islands, he returned to New Guinea, and now prosecuted his researches along the north coast. The state of his health rendering a change of climate necessary, he betook himself to Singapore, and thence to Sydney, where he founded a station for biological research. After another voyage to New Guinea and the Pacific Islands, he returned, in 1882, to Russia, taking with him rich collections, illustrative of the ethnology of the regions which he had visited. He had intended, during his stay in his native country, to publish a work on the results of his numerous voyages, when death cut short this design.

Palgrave, William Gifford, an Honorary Corresponding Member of the Society, first became generally known in 1865 by the publication of the narrative of his wonderful journey through the interior of Arabia in the character of a native Syrian doctor. He died on the 4th of October last at Monte Video, where he held the post of British Minister to the Republic of Uruguay. He was born in 1826, and was the second son of Sir Francis Palgrave, the distinguished historian and the Deputy-Keeper of the Public Records. He was educated at the Charterhouse, where he carried off the highest honours, and then at Trinity College, Oxford, where he graduated, and took a first-class in Classics and a second-class in Mathematics. Having then entered the Army, he went out to India, where he served for some time as a Lieutenant in a regiment of Bombay Native Infantry. Had he continued in the service of the Indian Government he would, no doubt, with his superior accomplishments and his aptitude for the acquisition of languages, soon have risen to high preferment. But the dream of his boyhood had been a missionary career in Arabia, and to realise this, he quitted the army, and entered an establishment of the Jesuit fathers in the Madras Presidency. He worked zealously for the Order in Southern India till 1853, when he went to Rome to complete the course of studies required by its rules. Having remained there for two years, he was sent on a mission to Syria and

Palestine, where, while actively employed in the interests of his Order, he studied closely the language, literature, and religion of the Arabs. He thus acquired such familiarity with the Arabic language that, as he states himself, it became to him almost a mother-tongue. In 1860 he was summoned to France by Louis Napoleon, who wished to question him regarding the disturbances that had taken place in Syria. He then undertook the task of exploring Central and Eastern Arabia in the service and at the expense of the French Emperor, and this with the sanction of his ecclesiastical superiors. In 1862 and 1863 he performed his memorable journey, in the course of which he traversed the entire Wahabee kingdom, and the provinces adjacent to the Persian Gulf and the Indian Ocean. One of his main objects in making it was to ascertain whether it would be eventually practicable for him to revisit the country for the purpose of teaching the people the doctrines of Christianity. He found that this would be impracticable. He then returned to Europe and resigned his connection with the Jesuit Society. In 1865 he published, in two volumes, the narrative of his journey. The work at once attracted universal attention. This was due not merely to the surprising nature of the facts which it disclosed, but also to its literary style, which charmed all readers with its easy idiomatic grace, its sparkling vivacity, and the *Attic salt* with which it was seasoned throughout. In the same year he entered the diplomatic service of the British Government, and was first sent to Abyssinia to negotiate for the release of Consul Cameron and his fellow-captives. He was appointed Consul successively at Soukhoum Kalé, at Trebizond, at St. Thomas, and at Manila in the Philippine Islands, and in 1878 Consul-General in Bulgaria. In the following year he was transferred to Bangkok, and in 1884 to Monte Video, where he died at his post. Besides the work which first made him famous, he was the author of *Essays on Eastern Questions*, *Hermann Agha, an Eastern Narrative*, *Dutch Guiana*, and *Ulysses*. In 1872 he read before the Royal Geographical Society a paper on the country between Trebizond and the Upper Euphrates, in which he gave a vivid account of the Lazes, who were newly settled in that region. He was a Fellow of that Society, and also of the Royal Asiatic, and an honorary member of several foreign scientific institutions.

Prjevalsky, General.—This distinguished Russian traveller, who has done more to throw light on the geography of Central Asia than any other man since the days of Marco Polo, died towards the end of October last at Vernoe, the capital of Semirechensk, one of the provinces of Russian Turkestan. He was at the time of his death engaged in organising an expedition, at the head of which he hoped to make his way to Lhassa, the sacred capital of Tibet, which he more than once before vainly tried to reach. The explorations which have made his name so well known extended over that wide, arid, little-known, and all but inaccessible, portion of Central Asia which is enclosed between the Altai, the Thian Shan, and the northern extremities of the Tibetan plateau, as well as over the regions about the Koko Nor, and the sources of the Hoang-Ho and the Yang-tse-Kiang rivers. In the course of his various journeys he had to contend

with numberless difficulties, and suffer all kinds of the most trying privations and hardships. Prjevalsky was born in 1839 on a small estate belonging to his family, which was situated in the district about Smolensk. After receiving his early education at a school in that city, he attended the Academy of the Staff Corps, and, on leaving it, entered the Russian army. As he had sufficient private means to live independently of his profession, he was free to indulge his love of adventure, and follow the bent of his genius, which strongly inclined to the natural sciences. In 1867 he volunteered for service in Eastern Siberia, where he remained for two years, spending much of his time in hunting and botanising in the valley of Ussuri. On his return to St. Petersburg he published his *Notes on the Ussuri*, in which he gave much valuable information regarding the territory in Manchuria, over which Russia had then recently extended her sway. In 1870 he again left Russia, and, in company with Lieutenant Pyltseff, travelled for about three years in Western China. The result of his explorations made in this tour were given in his *Travels in Mongolia*, which is the standard work on that part of the Chinese Empire to which it relates. His next enterprise, undertaken two years later, had for its main object the fixing of the precise position of the Lob Nor. In this journey, which occupied a year, he traced the course of the great river called the Tarim, which enters that lake after draining the whole of Chinese Turkestan. He reached also the Altyn-Tagh range, which forms one of the northern barriers of Tibet. His work entitled *From Kuldja across the Tian-Shan to Lob Nor* is his record of this journey. In 1879 he once more set out for Tibet, with the view of reaching its capital, Lhassa, from the north, but he was unable to proceed further than the region of the Koko Nor, where he was deserted by his guides, and suffered such dreadful hardships that he was obliged to retrace his steps, his main object unaccomplished. In 1885 he made yet another attempt to reach Lhassa, but again failed. In the course of this great expedition he crossed, as he had several times done before, the terrible desert of Gobi, and made his way along the outskirts of Kansu to the sources of the Hoang-ho in the marshy plain of Odontala, called the Sing-su-hai or Starry Sea. After leaving Odontala he crossed the water-shed between the Hoang-ho and the Yang-tse-Kiang by a lofty pass, where the air was extremely chill, even though the month was June. Being unable to cross the head-waters of the last-named river, he marched to Tsaidam, where his depôt was, crossed the Altyn-Tagh, and revisited the country around Lob Nor. Here he came upon traces of the wild camel, and made curious and instructive observations about the migratory birds which in vast numbers visit the swamps about the lake when on their passage to breed along the shores of the Arctic Ocean. He returned thence to Russia through Khoten, Yarkand, and Kashgar, which was probably the route he had selected for the journey to Lhassa, for which he was making preparation at the time of his death. Prjevalsky's love of science was not, it would seem, the only sentiment which stimulated him to undertake journeys so fraught with hardships and perils. He was animated also with an ardent zeal for advancing the influence and power of Russia in all the remote regions which he visited. We have only to add that he was a

man of a very noble type of character. His works have been made accessible to English readers in the excellent translations prepared by Mr. Delmar Morgan.

VELDE, LIEVEN VAN DE, a captain in the Belgian army and an enterprising African explorer, died, last February, from fever at Leopoldville, in the 38th year of his age. After having been sent thrice on expeditions to the Congo, he was finally selected to march to Yambuya and the Stanley Falls, for the double purpose of re-establishing the Stanley Falls Station and of gathering information as to the whereabouts of the Stanley expedition. J. W. M'CRINDLE.

NOTE ON THE KARUN RIVER, PERSIA.

THE question of the navigation of the Karun is one that has for many years occupied the attention of all who are interested in Persia, and conversant with the requirements and resources of the country. Where there is no mass of accumulated capital, and no income from freights, foreign investments, etc., it is manifest that the foreign trade of a country must depend entirely on the amount of the surplus products which it can export. That amount, again, depends not only on the absolute quantity of the products, but on the facilities or difficulties which exist in the way of transport. For bulky and comparatively cheap products, such as grain and cotton, the latter consideration is of prime importance. If their transport to the coast is too expensive, their export is an impossibility, no matter how superabundant they may be. These remarks apply in a very special manner to Persia, where the configuration of the country[1] makes the transport of heavy bulky articles peculiarly difficult.

Leaving Bunder Abbas and Lingah out of account, as too insignificant to affect the general commerce of the country, Bushire is practically the only free outlet for her produce which Persia has, and it is in many ways an extremely inconvenient one. The distance of the roadstead from the town entails much delay, expense, and trouble in the shipping and landing of cargoes. The inland road, moreover, from Bushire to Shiraz is a mere mule-track, 200 miles long, over a succession of rugged mountain-passes. From Shiraz the distance to Ispahan, which may be taken as the centre of the country, is 320 miles, and to Teheran, the capital, 600 miles, thus giving a total distance from Bushire to Ispahan of 520 miles, and to Teheran of 800 miles. Comparing these distances with those from Enzelli, the chief port on the Caspian, we find the distance to Teheran 200, and to Ispahan 480 miles. Even as far south as Ispahan, therefore, the distances are in favour of trade by way of the Caspian as compared with trade by way of the Persian Gulf. But the former route is closed to all the world except Russia, whose tariff is purposely prohibitive against all merchandise but her own. Free transit was formerly allowed through the Caucasus, and a considerable trade with Western Europe was carried on by that route. Simultaneously, however,

[1] *Vide ante*, page 5.

with the completion of the Batoum-Baku railway, connecting the Black Sea with the Caspian, free transit was abolished, and the ordinary tariff of the rest of Russia imposed. The only other means of access which Persia has to the Black Sea, and thence to the rest of the world, is by the long caravan route from Tabriz, *via* Erzerum, to Trebizond, which cannot be expected to compete with the railway across the Caucasus. In the north, therefore, Persia is gradually becoming more or less debarred from all trade except with Russia. On the west she has the grand natural highway of the Tigris, which flows close to her frontier from Baghdad to the sea. But here, too, her foreign trade is at the mercy of a neighbour—Turkey—within whose territory the valley of the Tigris lies. On the East, the natural and political conditions are such as to preclude the possibility of any foreign trade except of the most insignificant kind.

The mere statement of these facts is sufficient to show the importance to Persia—if she wishes to emancipate her trade, and thereby develop her resources—of taking every means in her power of improving present routes, and opening up new ones from the south, whence alone she has free outlet for her produce to all parts of the world.

The opening of the Karun to navigation is an indispensable step towards the establishment of such a new route—a route, moreover, which will greatly abridge the distances to be traversed by means of land transport between the central parts of Persia and the sea.

The Karun is entirely within Persian territory, and flows into the Shat-el-Arab, or united Tigris and Euphrates, at Mohammerah, a few miles below Busreh, from which point to the sea the tidal estuary of the Shat el-Arab forms the boundary between the Persian and Turkish dominions, and is therefore a water highway common to both.

Of itself, the navigation of the Karun will not do much towards establishing a great trade-route. Whether from Shushter direct to Ispahan, or from Dizful to Burujird, a good deal must be done to make the rough mountain tracks suitable for the passage of caravans, and to secure them from the depredations of the somewhat lawless nomads who inhabit this part of Persia. But the opening of the river to free navigation is a step—a great step—in the right direction, and an indispensable preliminary to any further action towards the development of the resources of the country, and the emancipation of its trade from what threatens to become a dangerous monopoly. R. Murdoch Smith.

GEOGRAPHICAL NOTES.

EUROPE.

Ancient Monuments in Scotland.—Mr. William C. Smith, Advocate, as Convener of a Committee of the Council of the Royal Scottish Geographical Society to inquire into the administration of the Ancient Monuments Protection Act, 1882, reports as follows :—

The Committee beg to report that there are no published returns as to the administration of the Act, but they have obtained the following information through correspondence with H. M. Board of Works, Whitehall.

1. No monuments have been acquired by the Commissioners by purchase or gift under sections 3 and 4 of the Statute.

2. Of the twenty-one Scottish Monuments originally scheduled to the Statute, seven only have been taken over by the Commissioners as guardians thereof under section 2.

There thus remain fourteen out of the twenty-one Scottish Monuments originally scheduled which have not received any statutory protection.

3. By Orders in Council, however, dated 7th March 1887, and 3d May 1888, the Statute has been extended to *inter alia* the following Scottish Monuments not originally scheduled, viz :—

The Pictish Tower of Carloway, Ross-shire.
The Ruthwell Runic Cross, Dumfriesshire.
St. Ninian's Cave, Glasserton, Wigtownshire.
The Cup-marked Rock, Drumtroddan, Mochrum, same county.
The three Standing-stones at Drumtroddan.
The Moathill of Druchtag, Mochrum.
The semicircular Earthwork on the sea-cliff, Barsalloch, Mochrum.
The Ancient Chapel at the Isle of Whithorn, Wigtownshire.

All these have been recommended for guardianship, and it is understood that the Commissioners are in course of being constituted guardians.

Of the twenty-nine English Monuments originally scheduled, fourteen have been placed under guardianship, and six additional monuments have been placed under the protection of the Statute.

4. No prosecutions have been instituted under the Act for defacement of Ancient Monuments.

5. The Committee applied to the Board of Works for copies of the reports made by General Pitt Rivers, as Inspector under the Statute, and also for copies of any representations made thereon by the Board of Manufactures for Scotland. They were informed that it would be impossible to supply copies without a heavy expenditure of clerical labour, and that no representations of any great public interest had been received from the Board of Manufactures.

The Committee have not heard of any case in which an application for statutory protection has been refused.

The Committee therefore think that the statements made at Manchester in September 1887 with reference to the administration of the Act must have been ill-founded or exaggerated. They do not advise the Council to take any action in the meantime, but, as the subject is one of great and increasing interest, they suggest the re-appointment of the Committee to obtain further information and to watch the further administration of the Act.

Dutch Town Populations, on 1st January 1888.—Amsterdam, 390,016 ; Rotterdam, 193,658 ; The Hague, 149,447 ; Utrecht, 81,398 ; Groningen, 53,090 ; Haarlem, 49,713 ; Arnhem, 48,297 ; Leyden, 46,079 ; Tilburg, 32,451 ; Maastricht (Mechlines), 31,621 ; Nimeguen, 31,113 ; Dordrecht, 31,067 ; Leeuwarden, 29,413 ; Delft, 27,591 ; Bois-le-Duc, 26,359 ; Zwolle, 25,525 ; Schiedam, 25,069 ; New Amstel, 23,050 ; Deventer, 22,700 ; Helder, 22,134 ; Breda, 20,849. In addition to the above-mentioned towns, there were forty others each with a population falling between 10,000 and 20,000. The total population of Holland was 4,451,000, the increase during the twelvemonth from 1st January 1887 being about 61,000, or at the rate of 1·4 per cent.—*J. F. Hoekstra, Junr., in Tijdsch. v.h. Nederl. Aardrijks. Gen.*, 2d ser., pt. iv., Nos. 5 and 6.

ASIA.

Geographical Progress in Russia (*November* 1888).—Our Hon. Corresponding Member, M. Venukoff, writes to us, under date 24th November 1888 :—"A commission, consisting of Messrs. Stebnitzky, Tillo, Mouchkétov, and Pomèrantzev, is giving its attention to the establishment of seismic stations in Russia. It has recognised the utility of such stations at Kharkoff, Tiflis, Tashkend, Irkutsk, and Khabarovka. Some of these towns already possess seismic apparatus ; but it is desirable that these instruments should be improved and that all stations should employ the same instruments and method in the study of earthquakes.

M. Lébédev, Director of geodetic and topographical surveys in European Turkey during the war of 1877-78, has published in ten volumes the results of the geodetic operations from which the map of Bulgaria, in 104 sheets, was constructed. This will be considered a standard work by all who are interested in the geography of the Balkan Peninsula.

The Caucasian Section of the Russian Geographical Society has just published a map of the Russo-Afghan frontier, as it is at the present time (1888). This map, on the scale of $\frac{1}{840000}$, represents, not only the line of demarcation between the two States, but also the adjoining districts from Herat to Merv and Balkh. The delta of the Murghab, in particular, is delineated with great care. A pamphlet of 42 pages, accompanying this map, narrates the progress of the work of delimitation ; its author is M. Koulberg, late Russian Commissioner.

Captain Gronbtchevsky has just accomplished a journey accross the Pamir plateau to Kunjut. He has explored again the Mustagh range, described by Mr. Younghusband in 1887, and the Taghdumbask at the south of Pamir, the only part which was still unknown. M. Gronbtchevsky was stopped by the Chinese at Tashkurghan, the very place where Bonvalot in 1886 threatened to cut off the ears of the Chinese commander of the post. Like the French traveller, he continued his journey southwards in spite of the opposition of the Chinese. M. Gronbtchevsky is expected in St. Petersburg, where he will be received by the Emperor.

The Lakes of Upper Armenia : Variations of Level.—Dr. Robert Sieger has published a pamphlet,[1] in which he has collected a considerable amount of information connected with these lakes. Much of it is almost useless, for some authorities are contradicted by others, or the records of the height of the water are not accompanied by any statement of the time of year, when the lake was observed. Allowance must be made also for the crumbling in of the banks, enlargement of river deltas, etc., but the effect of these changes would only become apparent in long periods of time. From notices of the position of towns with regard to the lake, the formation of islands, and their re-connection with the mainland, and from the perimeter of the lake as shown in maps, it may be concluded that Lake Van is subject to periodical variations. Little is known of the alterations of level in the other smaller lakes in the same basin, but that little tends to show that they, too, rise and fall, and at about the same time as the Van. Lake Urumiah, on the Iranian steppe-land, and Gotcha, in the domain of the Caucasus, seem also to rise and fall during nearly the same periods as the Van. All these lakes have no outlet, or at any rate only occasional ones, and are therefore salt. Dr. Hann has already laid down the rule that such lakes are liable to these variations, and that they rise and fall according to the annual rainfall. Dr. Sieger wishes to illustrate this maxim by the particular case of

[1] *Die Schwankungen der Hocharmenischen Seen seit* 1800, etc. Wien, 1888.

the Armenian lakes. No satisfactory series of rainfall observations can be obtained from Turkey, and Dr. Sieger is therefore obliged to fall back on the Russian records from Alexandrapol, Tiflis, Baku, etc., which, unfortunately, do not go back further than 1845. Alexandrapol, the only Armenian station, furnishes records up to 1870 only. The rainfall, however, is shown roughly to have been considerable during the periods when the lakes were high ; and, if the limits of these periods were more strictly defined, the connection might appear closer. Dr. Sieger shows that the glaciers of the country have also advanced and receded in the same periods. The concluding chapter treats of lakes and variations of climate in all parts of the globe.

Bhutan.—Little new information has been acquired about Bhutan since Captain R. B. Pemberton's mission in 1837-38. The route survey of Major Godwin-Austin from Daling to Punakha in Western Bhutan, and the journey of the "Pundit" through Men Tawang and Men Chuna in the east, have yielded almost all the only additional knowledge of the country. Lately, two travellers, native surveyors, R. N. and P. A., have traversed parts of Bhutan, and some notes on their discoveries are given by Colonel Tanner in the *Report of the Survey of India Department* (1886-87), accompanied by a map of the country, whereon the routes of these and former travellers are marked. R. N., starting from Darjiling, commenced his traverse at the Pango-La pass ; while P. A. entered Tibet by the Jelap-La pass, crossed the Miru-La, and joined R. N.'s route near Battejong in the Ha valley. The Ha Pa, the inhabitants of this, the Giaba, district, speak a patois of Tibetan. The Bhutanese, or Duk Pa, occupy the central part of the country, and speak a language distinct from the Tibetan, but written in the same character. Across the Giaba-La pass (9800 feet) R. N. reached the valley of the Wong Chu (Pemberton's Tchinchoo), where he first met with the Duk Pa. The Wong Chu is one of the seven great rivers of Bhutan, and has already been described by Pemberton. Owing to disturbances in Bhutan, R. N. deemed it wise to leave the country at Baxa Duar fort and to re-enter it at Dewangiri rather than strike into the interior. Ascending to the Diri Chu, and crossing the Dangma Chu (described by Pemberton), he came to Kuru (Lama U. G.'s Lhobra). This river, omitted by some curious oversight in Pemberton's description of the rivers of the country, now proves to be the largest. The country between the Diri Chu and the Thungsi-La pass is inhabited by the Chingmis, a tribe of mixed race, half Bhutanese and half Men. They are an amiable race. The men dress like the Bhutanese but the women in a costume similar to that of Garbiang in Kumaon. Both sexes wear pigtails. From the Thungsi-La pass (12,500 feet), on the north-western frontier of the Chingmi country, a splendid view was obtained of the Kulha Kangri, or Chamaliri group. R. N. then descended into the Pumthang valley, which he considers one of the pleasantest in Bhutan. The slopes are dotted over with woods and isolated trees. Yaks and all domestic animals are plentiful, and game abounds. Following the valley northwards, R. N. left Bhutan by the Monla Kachung-La pass (17,500 feet), the position of which he connected with Kulha Kangri by observations. It had been his intention to attempt the solution of the Sanpo problem, but he was forced to make a precipitate retreat from Se Shangkar, in Tibet, and travel through a very elevated country to Men Chuma, whence he returned to India through Men Tawang. R. N. made a few very fragmentary notes of the manners and customs of the people, and has translated from Tibetan a vocabulary of the Chingmi dialect, compiled by the Lama U. G.

Upper Burma.—A few geographical data may be gathered from the *Report on the Operations of the Survey of India Department* during 1886-87. Major Hobday gives a narrative of journeys he made to Thonze, Mainlung, and Thibaw in the northern Shan States. These towns lie to the east of the Mandalay district. The country, in which the first two are situated, is an elevated plateau of an altitude of 2000 or more feet, bounded on the Burmese side by chains of mountains where the passes are 3500 to 4700 feet above the sea-level. To the north of Mainlung are the ruby mines, situated on a diamond-shaped plateau, at an altitude of from 4000 to 5000 feet. This plateau covers an extent of about 18 square miles, and is bounded by lofty peaks, the highest, Taungem, to the north-east, attaining an elevation of over 7000 feet. The mines are worked by a race called Maingthas, who come every year from the borders of Yunnan to seek employment. The Maddeya River flows through Mainlung, following in this part of its course a north-westerly direction towards the ruby mines. Between Thonzé and Thibaw lie ranges of hills, separated by valleys through which tributaries of the river Myit Nge flow southwards. Major Hobday specially describes a gorge between Nammaw and Gnoktaik, where the road crosses the Namsan River by a natural bridge of rock, and is carried up the opposite face by means of steps cut out of the cliff. Thibaw stands on the river Myit Nge at an elevation of about 1500 feet only. The altitudes observed both on the east and west of the Myit Nge valley varied from about 2500 to 3500 feet. In the neighbouring state of Taungbain tea is grown in large quantities by the Palungs. Lieutenant Jackson describes his journey to the southern Shan States. Whereas the rivers to the north flow into the Irawadi, the streams which drain this country are tributaries of the Salwin. Between the Lake Inle and the frontier of the Yamethni district lies the plateau of Myelat, 4300 feet above the sea-level, which is in the possession of a confederacy of small states, the chief being Pwayhla and Thamakau. It has a clay soil, extensively cultivated by the Taungnus, an industrious race allied to the Shans, and is enclosed by limestone crags. The lake is nine miles long by two broad, and terminates at either end, north and south, in long stretches of marsh. Its water is shallow and beautifully clear; the average depth is six feet. Coarse fish of many kinds abound in the lake, and in winter the surface is covered with wild-fowl. Villages are built over the water on piles, and floating gardens, somewhat after the fashion of the Mexican *chinampas*, are cultivated. On the eastern side stands the post known as Fort Stedman; on the north the lake receives the waters of the Baluchaung; on the west the Pungdaw River, which drains the Pwayhla plateau, enters by a tunnel, excavated for half a mile through the limestone rock. Lieut. Jackson followed the Paungdaw for a distance of eighty miles from the point where it flows out of the lake again, as far as Peyakon, where he found the Tsawba of Mobye, who had retired thither that he might live unmolested by the Red Karins, a people notorious for kidnapping and stealing. The river, it is said, disappears underground in a kind of swamp ten miles below Peyakon. The streams to the east of Lake Inle are, first the Tabet, and next the Pon, which further south receives the waters of the Tabet, and is one of the most important affluents of the Salwin. The highest point between the Baluchaung and the Tabetchaung is Myinmal's Peak, 6600 feet, and the hills between the Tabet and the Pon reach a height of 7500 feet. Still further eastwards runs the river Namtein. Mone, standing beside a large marsh formed by this river, was formerly a flourishing and considerable town, to judge by the number of pagodas, but the unhealthiness of the situation and continual disturbances have put an end to its prosperity. Mokmay, on a tributary of the Namtein, is the largest,

most populous, and apparently richest, town of this part of the country. The whole broad flat valley of the Namyon River is here irrigated by many large channels, and is well cultivated. The vegetation partakes of a tropical character.

From the *Preliminary Report* on the administration of Upper Burma in 1887-88, a few geographical data may also be gleaned. Surveys of nearly 20,000 square miles have been completed; the Mandalay triangulation has been extended to Bhamo, and connected with the Lower Burma series; and several maps have been published, among which may be mentioned the preliminary maps of Upper Burma and the maps of the Cis-Salwin Shan States and of Mandalay. The ruby, earth-oil, indiarubber, amber, and jade-stone monopolies have been retained. They are not, properly speaking, monopolies, but revenue derived from the products of land belonging to the State. The other sources of revenue are bazaar-rents, ferry-leases, excise and opium, salt, and the tribute of the Shan States. The total amount actually collected during the financial year 1887-88, was Rs. 4,922,285, more than double the returns of the preceding twelve months. Trade has developed considerably during the year. The Burmese are born traders, and trade never came to an entire standstill during the disturbances. Goods, where there are no rivers, are carried by pedestrians or bullocks. Cotton is exported to China, and, it is suspected, opium and sulphur are imported from that country along the Shweli. Rice, tobacco, betel-nut, kerosine-oil, ground-nuts, saffron, lac, tea, etc., are objects of trade between the different districts, some of which are shipped at Mandalay to be exchanged in Lower Burma for European goods. Combined post and telegraph stations are in course of erection at the chief towns of the districts, even as far north as Bhamo. Better communications would cause a great increase of trade. On the Chindwin the Irawadi steamers do not ply above Kindat, and the country further up has been too much disturbed for native boats. Roads are now being made and mule-tracks opened, but it will be long before all that is necessary in that direction is completed.

The Volcanic Eruption in Japan.—The *Times* of November 24th last gave further and more precise details concerning the eruption of Sho-Bandaisan (*vide* vol. iv. p. 605). The earthquake, which preceded and accompanied the outburst, was only felt within a radius of 30 miles, though the sounds it produced were heard 62 miles to windward. From this fact the Japanese experts, Messrs. Sekiya and Kikuchi, infer that the centre of explosion was little below, even if not above, the sea-level, in the mass of the mountain itself. Black columns of volcanic dust mingled with steam rose to a height of 12,000 to 15,000 feet above the volcano, and then spread out into a cloud, from which the dust (augite-andesite) rained down over the country. The region covered by this shower extends in the shape of a half-opened fan to the shores of the Pacific, 62 miles from the mountain, and has an area of 1040 square miles. The deposit is about 6 inches deep near the mountain, and gradually diminishes in depth to a scarcely perceptible film on the shore. The crater-bed is in the form of a horse-shoe, 1½ miles broad at the mouth, and contains an area of 950 acres. Round the crown of the crater runs a nearly vertical wall of rock 1660 feet high. Within this hollow lay the former summit of the mountain, which rose to a height of 540 feet above the existing crater. This huge mass, measuring not less than 1587 millions of cubic yards, and weighing 2880 million of tons, was blown off, broken up, and spread over 27 square miles of country to an average depth of 57 feet. When Professor Sekiya examined the ground, it was a mystery to him how such a huge mass could have been thus distributed, but later on he had an

opportunity of witnessing the phenomenon on a small scale. As he was at work near the crater, a huge slab, 1000 feet high, and of considerable thickness, fell from the encircling wall, and dashed down into the valley below. As it progressed with increasing velocity, the great mass was broken up by contact with obstacles in its course, and the fragments, dashing together, became more and more disintegrated until, a large proportion being reduced to a fine powder, the slab was converted into a stream of fine particles bearing on its surface a few slabs and boulders which had escaped detrition. Such, no doubt, but on a far grander scale, was the process by which the summit of Sho-Bandaisan was reduced to sand and deposited over the fields. Two streams of solid material descended from the mountain on the day of the eruption, July 15, and with such velocity (Professor Sekiya estimates it at 50 miles an hour) that they were able to surmount hills and ridges fully 100 feet high. The volcano is now perfectly at rest. A line of steam-jets issuing from a fissure in the crater, which doubtless marks the line of least resistance, are the only sign of volcanic action; delicate tremometers are unaffected. The most striking feature of this eruption was its appalling suddenness, and it must be owned with regret that seismologists are as unable as ever to foretell earthquakes and eruptions.

AFRICA.

The Divisions and the Distribution of the Berber Population of Marocco.—The subjects of the Sultan of Marocco belong to two races, the Arab and the Berber. Some derive the latter name from "barbari," but various traditions and the use of the term by the Berbers themselves tend to disprove the theory that the name was given by the Romans. Three groups of Berbers, differing essentially in language, type, manners, and customs, may be distinguished. The first is that of the Rif-Berber, who occupy a mountainous country on the shores of the Mediterranean, extending to the Algerian frontier. The territory of the second group, Berbers *par excellence*, extends from Fez and Miknasa to the eastern half of Mount Atlas and across it to Tafilet and the upper part of the river Draa. The third, the Shelluhs, dwells in the Atlas and Anti-Atlas ranges and along the coast from Mogador southwards. M. de Foucauld applies the name Berber to the Kabyles of the Sahara only, and considers it an error on the part of the Arabs to designate the tribes of the second group by this name. This use of the word, however, is based on similarity of language and habits, in which the Kabyles of the south approach more closely to the Berbers of Central Marocco than to the other groups. As for Kabyle (Kebail), it is an Arab word meaning simply a tribe, and is applied both to Arabs and Berbers. The Rif-Berbers occupy the district proper of Er-Rif and the adjoining Garet, which terminates at the river Muluya. Beyond this river eastwards dwell the Beni Snasen, who speak a dialect differing from that of the Rif-Berbers. On the coast, Spain possesses three "presidios," Peñon de Velez, Alhucemas, and Melilla, small fortified towns employed chiefly as convict stations. The garrisons of these towns live in a perpetual quarantine, as no stranger is allowed to pass through Berber territory, and the only intercourse they have with the Berbers is in procuring victuals. Many Berbers, who have killed a man, and have therefore had to fly—for the *jus talionis* is rigorously observed among this people—are to be met with in Tetuan and other towns, where they often engage themselves as workmen, and are considered very efficient. Some of them serve also as soldiers in Spanish service. They are not nomads, nor do they live in tents, but in closely-built villages of stone and wooden houses.

Their costume is different from that of the other Berber groups, but very similar to that of their neighbours, the Jebela. The Rif-Berber, however, goes bare-headed, except in bad weather, and wears a plaited lock of hair on the right side of the back of the head, while the Jebeli shaves his head in Moslem fashion. The latter is a tribe of Berber origin, which has adopted the language of, and in some degree mixed with, the Arabs ; they occupy the mountains (Jebel) lying between Tetuan and Wezzan and extending eastwards to Garet. Both they and the Rif-Berbers, as indeed all the Berbers and many Arab-speaking tribes, are almost independent of the Sultan. In 1873, Muley Hassan led three expeditions (harkas) against them, which, ending without bloodshed, yet won him the respect of the Rif-Berbers. In 1876 he defeated the Beni Snasen, and appointed kadis over them. The Rif-Berbers are of medium stature, broad-shouldered, and powerful. It is strange that among this tribe one frequently sees men with very fair or reddish hair and blue eyes. Some have maintained that this type was to be found among all inhabitants of mountainous country, while others conjecture that these fair Berbers may be the remains of the prehistoric race, which erected the megalithic monuments still found in North Africa. Roman soldiers or Vandals also may have sought refuge among the Berber tribes. The number of these Berbers is estimated (quite arbitrarily) at 200,000 by Grey Jackson.

At the north-west of the territory of the second group the tribes Girwan and Semur-Shelluh extend beyond Miknasa, half-way to the Atlantic. The fourth meridian of west longitude marks out pretty accurately their eastern limit. To the south-east these Berbers are bounded by the Haratin of Tafilet and Ferkala, and to the south they come in contact with the Draua, tribes which have a large admixture of Negro blood ; to the south-west they join the Shelluhs. All these Berbers, except one or two tribes on the western border, are really independent of the Sultan. He keeps up a show of authority, and exacts contributions from them by almost annual harkas, in which he does not always escape defeat. This territory is almost as inaccessible as that of the Rif-Berbers. But, as the Berbers would exclude themselves from the advantages of trade if no trader could enter their country, they have established the custom called "Anaia." When a traveller crosses the frontier, he halts at a caravanserai (Duar or Nesâla), and by letter, or through a friend, communicates with some powerful person in the tribe, who comes and agrees, in return for a sum agreed upon, usually very moderate, to guarantee the safety of the traveller, and provides him with an escort. Such security is only granted to an Arab or native Jew, never to a European, and therefore the few Europeans who have visited the Berber territory have disguised themselves as Arabs or Jews. M. de Foucauld chose the disguise of a Jew, and travelled with a Jewish rabbi. He was less liable to detection amongst Moslems than in the disguise of an Arab, and, in case of discovery, the Moslems would not be so exasperated, as if he had entered their holy places as one of themselves. M. de Foucauld was thus able to make a journey of eleven months in an almost unknown country and, continually in the midst of dangers, to record astronomical and meteorological observations, and draw plans and sketches. The Jews are in very bad odour among the Berbers : some tribes do not hesitate to break faith with them, and even kill them, while others consider it derogatory to waste a bullet or a dagger blow on a Jew, and content themselves with ill-treating him.

The Berbers do not, like the Arabs, recognise the Koran as a civil code, but each tribe, or even locality, has its peculiar laws based on tradition. The government consists of an assembly, sometimes of 100 men or more, presided over

by a sheik, who finds it a hard task to keep these restless spirits in order by cunning, bravery, and physical superiority. In certain tribes the authority of the sheik is subject to certain constitutional restrictions. Almost all crimes and misdemeanours are punished by a fine, but these punishments are only inflicted for misdeeds committed within the tribe. Robbery and theft are favourite pursuits of the Berbers : to steal is honourable, to be found out is dishonourable. The Berbers are continually at war among themselves. In 1883 a battle took place between two tribes, who could not agree about a piece of territory, in which 1000 men were killed or wounded. It is this want of union among the Berbers, as well as the Sultan's possession of artillery, which enables the latter to hold his own against this numerous and warlike race.—*M. Quendenfeldt, in Zeitschrift für Ethnologie,* Heft 2, 3, 1888.

Lower Guinea.—Lieutenant von François has returned from his expedition to the country of the Mosi. He passed through Kpandu, Salga, Yendi, and Gambaga, and then, crossing the Volta near Bupere, where the river was nearly 90 yards wide, though not navigable so far up, reached Surma, in the territory of the Mosi (about 11° 28′ N. lat.). At this point he turned back, and, passing Nantong and Salga, met Dr. Wolf at Adele. The latter traveller had just founded the station Bismarckburg on Mt. Adado, having reached the place from the eastern side of Togo-land beyond Atakpame. He had contrived to carry a mercurial barometer with him, so that the altitudes he has recorded are of an accuracy unusual in Equatorial Africa. The Imperial Commissioner also, Herr von Puttkamer, has travelled on the Mono and in Agotime in the west. All three travellers agree in stating that the country behind Togo is a very promising field both for commerce and agriculture, and that, owing to its mountainous character, it enjoys a much better climate than the coast.

News comes from the Cameroons that Dr. Zintgraff has explored the country from the neighbourhood of Barombi station to the northern side of the Calabar River. Lieutenants Kund and Tappenbeck were, at the end of last July, about to erect the fortified station, already planned, at the Edea Falls on the river Sanaga.—*Petermann's Mitteilungen,* vol. 34, No. xi.

Eastern Equatorial Africa.—In consequence of the native and Arab insurrection on the East Coast of Africa, by which the administration of the German sphere of influence has become impossible, the Imperial German Government has secured the co-operation of the British Government in instituting a blockade of of the coast between 2° 10′ and 10° 28′ south latitude against the importation of munitions of war and the exportation of slaves. The Portuguese have also strengthened their squadron, and are taking parallel action opposite the province of Mozambique. The French Government have sent two vessels to inspect dhows flying the French flag, in order that the long-standing abuse of transporting slaves to Madagascar and the Comoro Islands under French colours may, if possible, be put a stop to. The blockade, which commenced on 2d December last, is to be conducted independently by the British and German admirals on the station. The German squadron is reported to have bombarded and burnt several coast towns, by which a number of British Indian subjects have lost their property. The Germans had previously been forced to retire, in consequence of the native armed resistance against German rule. The loss of life has been considerable. The British admiral has been instructed by Lord Salisbury not to engage in any land operations, from which the most serious consequences are anticipated. The territory of the Imperial British East African Company is, happily, free from any insurrectionary movement at the present time, but

commerce is paralysed on the coast. The British Company has abandoned its scheme of despatching Mr. Joseph Thomson at the head of a caravan to Wadelai, and is understood to have taken steps to recall Mr. Jackson, who was leading the caravan into the Interior. Lieutenant Wissmann, however, on the part of the German Company, is still under orders to proceed to the East Coast, and Dr. Peters is to follow, their intention being apparently to assist in pacifying the coast district.

Count Teleki in Eastern Equatorial Africa.—The *Mitteilungen der k. k. Geographischen Gesellschaft zu Wien*, Nos. 7-9, contain the diary forwarded by Count Teleki's companion, Lieutenant von Höhnel, to the Archduke Rudolph. An attempt with seventy-seven men was made to ascend Kilima-njaro, but Teleki only succeeded in reaching the snow-line, where the rarity of the air and a feeling of drowsiness induced him to turn back. The last entry in the diary was made in the country between Likipia and Lake Baringo. A letter, addressed by Lieutenant Höhnel to his brother and written at Lake Baringo, Christmas, 1887, mentions the existence of two large lakes in that country. According to the reports of the natives one of these lies to the north or north-north-east of Lake Baringo, and is called Basso Ebor (White Lake). This is no doubt the lake known to Europeans by the name Samburu. The other to the north-west, the Basso Narok (Black Lake), is of immense extent, in the eyes of the natives. As for Samburu, Lieutenant von Höhnel declares that it is not the name of a lake but of a district lying to the south of Basso Ebor. The *Deutsche Rundschau* reports the return of Count Teleki to Mombasa, and adds that the Count discovered the Basso Narok to the north of Baringo Lake, and found that it extended from 2° 20′ to 3° North latitude.

AMERICA.

Arizona.—Prince Roland Buonaparte has forwarded to the Paris Geographical Society (*Compte Rendu*, Nov. 14th, 1888) a letter from Dr. Ten Kate, who took part in the Hemenway South-Western Archæological Expedition. He has come to the conclusion that the ruined villages found at Los Muertos and Acequias owe their construction to the ancestors of the present Pueblos Indians, or to a kindred race. The building materials are baked earth or natural cement. Numerous objects have been found, principally pottery, both plain and decorated; also arms and implements of bone and polished stone, ornaments made from sea-shells, and more than 300 skeletons, some of them fairly perfect. The type is similar to that of the modern Pueblos, that is, a brachycephalic skull with a flattened occiput, and a low stature. The inhabitants of these villages practised cremation as well as interment. Large numbers of vases have been found filled with calcined and fractured human bones. In the surrounding country traces of a network of irrigating canals have been discovered.

Prevention of Floods in the Lower Mississippi.—The United States Geological Survey, having conceived a plan for reclaiming waste lands by storing the waters of the Missouri for irrigation, has written to Director Powell to inquire, what would be the probable effect of this measure on the waters of the Mississippi. The following details are extracted from his report:—The ends to be aimed at are, to prevent the choking of the river channel by sedimentary deposits, and to diminish the quantity of water poured into the river during floods. The quantity of water passing New Orleans is on the average 675,000 cub. feet per second, and during floods rises to a million cubic feet per second. The amount of sedi-

ment discharged into the Gulf of Mexico is on the average $\frac{1}{2000}$ part of the total volume discharged, and about half of this comes from the Missouri. The average annual output of the Missouri would form a levee 100 square yards in cross section, and 1000 miles long. Now, when a river is full of earthy matter, it deposits it on the bottom of the channel wherever there is least current, thereby filling up and changing the direction of its bed, and overflowing its banks when an increase of water descends from above. To store up the waters of the Upper Mississippi or Ohio, which are comparatively pure, would certainly at first relieve the congestion in the main stream, but the evil would soon be aggravated, seeing that the increased percentage of matter would give the river greater powers of erosion. On the contrary, were the waters of the Missouri stored so that they might deposit their sediment before entering the Mississippi, the purified stream would do much to keep its bed clear itself. Two ends would thus be obtained by the same measure, the fertilisation and the irrigation of the waste land in the basin of the Missouri, and, to a great extent, the prevention of floods on the Mississippi.—*Science*, August 24th, 1888.

M. Jean Chaffanjon, the explorer of the countries of the Upper Amazon and Upper Orinoco, is about to undertake a new task. He is going to explore the peninsula and lake of Maracaybo. A tribe of Indians lives on the peninsula, concerning which no scientific data have been obtained, for they allow no one to go among them. M. Chaffanjon will try to penetrate this mystery, and hopes to succeed by means of the friendly relations which he has already established with an important chief. He will also examine the lacustrine dwellings of an extinct race in the Maracaybo Lake, and then, following the chain of the Andes, will ascend to the source of the Magdalena, cross the group of mountains which separates this river from the Rio Canca, and explore the latter down to Antioquia, a curious town, the neighbourhood of which is rich in traces of a civilisation probably intermediate between those of the Incas and of the Indians in the llanos of the Orinoco.—*La Géographie*, Nov. 25th.

The Galapagos Islands.—*Globus* (No. 16, 1888) contains a short account of these islands, which belong to Ecuador. They derive their name from the land tortoises, which were formerly to be found there in large numbers. Their area is over 2900 sq. miles, of which only one-third is cultivated. The southern side of the islands is covered with soil and a luxuriant vegetation, owing to the considerable rainfall, while the northern side consists principally of bare lava, in the clefts of which thick brushwood grows. The group lies on the Equator about 600 miles from the continent of South America, and consist of four large and several smaller islands of volcanic origin. They had no aboriginal inhabitants, but towards the end of last century they afforded anchorage to whalers, and now contain a small population, most of it on the most easterly island, Chatham, which contains 250 inhabitants, or, according to a recent *Bulletin* of the American Geographical Society, 150. This publication states also that the population consists almost entirely of convicts from Ecuador, to which State the islands belong, and that they are governed by a man of Spanish race, named Gobos. They dispense almost entirely with clothing, and have no religion. A good carriage-road leads to the settlement, Progreso, which lies five nautical miles inland, and, though commenced in 1879, is already in a flourishing state. Sugar-cane is the chief crop, but, besides sugar and the residuary products, molasses and rum, sweet potatoes, hides, and leather are exported. Turtle oil was formerly an important export, but now the turtles are nearly exterminated. Cotton, potatoes, vegetables, and all kinds of cereals, except rice, are cultivated.

Cattle, goats, horses, asses, and pigs were introduced into Chatham and Charles Islands forty years ago, and in 1886 the number on Chatham Island alone was at least 6000. The climate is fine and healthy, and the heat, natural to places on the Equator, is tempered by the cold current flowing from the Peruvian coast. Both the flora and fauna are peculiar. The large number of native animals and plants is very striking; even the birds are different on individual islands. The most conspicuous plants are ferns, *Synantheræ*, and *Leguminosæ*. These thrive on the fruitful uplands, while cacti, *Euphorbiæ*, and acacias spring from the dry sand. Besides the turtles already mentioned, a hideous lizard and a large mouse are indigenous. The mountains of the islands, volcanic in character, attain an elevation of 4600 feet, and generally assume the form of a central crater surrounded by a number of subsidiary cones. The largest island is Albemarle, which has an area of over 1540 sq. miles, and is formed by six volcanoes not yet extinct. Other islands are Indefatigable, James, and Narborough, a single active volcano.

ROUTES, RAILWAYS, CANALS, ETC.

The Railways and Telegraphs of Asia.—The progressive development of commerce has induced the States of Asia (even those not subject to European influence) to commence or extend their systems of railway in order that they may reap the benefits of foreign trade. The time is as yet far distant when a network of railways will bring all parts of the continent into communication with one another. The railways of each individual State are at present quite isolated, and India is the only country which possesses a railway system at all adequate to the demands of trade. The Russians are constructing two trunk lines in their Asiatic provinces, the Trans-Caspian and the Siberian, the former of which runs from Uzunada, on the Caspian, through Askabad and Merv to Bokhara, and will be continued through Samarkand, Tashkend, and Zaisansk to Semipalatinsk, where it will divide into two branches running to Tomsk and Omsk respectively, stations on the Siberian line from Tiumen to Vladivostock. A line from Perm through the Ural Mountains to Tiumen is already finished. The Trans-Caspian line will be connected with the Russian railways by a line from Tashkend to Orenburg. Three lines will provide communication between China and the Russian territory, the first from Peking through Mukden to Vladivostock with a branch to Seúl in Corea, the second from Peking through Maimatchin to Kiachta, and the third from Kaifong through Ngau-si to Zaisansk. Numerous railways are projected in China. Takir is already connected with Tientsin, and the line will be continued to Peking. Lines will also connect Peking, Kaifong, Nanking, Shanghai, Canton, and Chunking, and will join the railways of Burma, Siam, Yunnan, and Tonkin, when these are constructed. From Hanoi a railway is proposed to Hué and Saigon, and from Hué a branch is to run to Bangkok. From this town also a line is to be made to join a Chinese line from Yunnan. Two railways are already constructed from Rangoon towards the north, and the more easterly of these is to join the Chinese lines at Tali. Kashmir will be connected with the Indian system. A line is planned from Peshâwar through Kabul to Teheran, and another from Quetta through Kandahar to Ispahan. Short lines already exist, running from Scutari and Smyrna, of which the former will be prolonged across Asia Minor through Diarbekr and Baghdad to Bussorah. This line will be crossed at Baghdad by another running from Suedia to Ispahan. Of the islands, Java and Nippon have the most extensive lines, and Ceylon ranks next. New railways are projected

in Manila and Sumatra. Such is the account given in the *Deutsche Rundschau*; probably it will be very many years before these numerous schemes are carried out, and, in many cases, before the construction of the lines is commenced.

Telegraphs are much more readily constructed, and therefore precede railways. They already skirt the Russian frontier, the coasts of China, and Further India, traverse Japan and India, and connect the latter country with Europe and Australia. All these lines, both railway and telegraph, are shown on a map published in the *Deutsche Rundschau*, xi. Jahrgang, Heft i.

A New Siberian Railway.—Yet one more line must be added to the long list of railways projected for the development of Asiatic commerce. The one in question has also this novelty, that, though passing through Russian territory, it is a private undertaking. The *Compte Rendu*, No. 14, of the Paris Geographical Society, reproduces the account given by the *Messager de Cronstadt*. A concession has been granted to M. Golovatcheff to construct a line connecting the Ob with the Arctic Ocean. It will start from the river Malaïa-Ob, near the town of Obdorsk, pass the Urals by a transverse valley at a comparatively low elevation, and then, crossing the Ussa, reach the ocean at the Bay of Shaïnondir to the north of Belcoff Nosse. The length of the line will be a little over 265 miles, and its total cost, including rolling-stock, is estimated at 15 million paper roubles (£1,344,583). To this must be added 2 million roubles for the construction of a port, and 3 millions for 34 steamboats, each of 80 horse-power and 800 tons burthen, and having three lighters in attendance on it, which will be required to convey goods down the Ob and Irtish. Consequently, the expenditure necessary to bring this line of communication into working order will be 20 million roubles (£1,792,777). The line will be worked for six months in the year, during which time twelve trains of twenty-five trucks each will be run daily. At present the freightage from the most remote towns, such as Büsk and Barnaul on the Ob, and Semipalatinsk on the Irtish, to London through Tiumen, Perm, and St. Petersburg, is 73 kopecks per pood (about 39s. 7d. per ton), and the time of transport is sometimes as long as 130 days, whereas it is expected that by this new line the freightage will be reduced to 42 kopecks (22s. 9d. per ton), and the time of transport to 24 days. Statistics prove that the province of Tomsk and Tobolsk are capable of exporting 10 million poods (161,220 tons) of wheat annually. The railway will also transport raw and tanned hides, flax, and hemp, furs, isinglas, turpentine, wood, and other less important articles, in return for which it will bring into the country hardware and machinery, groceries and drapery, glass and pottery.

Navigation of the Upper Yang-tse-kiang.—Chung-king, the capital of the province of Sze-chuen, lies on the Yang-tse-kiang, about 1500 miles from the sea. In 1877, when the Chi-fu Convention was framed, Chung-king was not opened to foreign trade, because it seemed doubtful at the time whether, owing to the rapids near Y-chang, steamers would ever succeed in ascending the river. It was, however, provided that, should a steamer at any time reach the town, arrangements for opening the port to foreign trade should then be taken into consideration, and that, in the meantime, a British agent should be stationed at Chung-king to investigate the commercial capabilities of the country. The officers appointed successively to this post reported that the river was navigable by steamers during nine months in the year at any rate, and that all difficulties might be overcome by building a steamer specially designed for the purpose. In consequence of this report, Mr. Little, a merchant, who already was running a steamer from Y-chang to Hankow, personally inspected the Upper Yang-tse-

kiang, and, having formed a small company in England, had a steamer built and sent out in pieces to Shanghai. It was there put together, and was taken up the river to Y-chang. The Chinese then interfered, and objected to the steamer ascending the river. They affirmed that the people would be fearful lest they should lose their occupation of transporting goods in junks, and that serious consequences might arise. Since then, the Chinese Government has issued instructions to the local authorities to prepare the populace for the coming event. These authorities, finding at length that resistance was vain, have issued proclamations, many of which have been published in the *Times*, setting forth the advantages that will accrue to the inhabitants when the trade of the province is developed by improved means of transport. And now, the *Times* (November 10th, 1888) states, the little steamer will be allowed to proceed, and, if successful, will give a fresh impulse to the trade of Sze-chuen.

The Nicaragua Ship Canal.—The surveys for the final location of this canal have been completed. The line adopted is the same in general direction and total length as the one fixed by the survey of 1885, which was reported in the *Magazine* of last year, but more minute examination of the ground has revealed the practicability of improvements, whereby the length of the canal to be excavated will be shortened and the length of free navigation increased. This is to be attained by the formation of two new basins, the Tola near Port Brito, and the Deseado, to the east of the San Francisco basin. These will give 5·28 and 4 miles respectively of free navigation, to which must be added an increase of 2·13 miles in the free navigation of the San Francisco and Machado basins. The result will be to diminish the excavated length to 28·89 instead of 40·3 miles, and to increase the free navigation by this difference. The summit level will be extended from 144·8 to 153·8 miles. It is expected that these changes will produce a saving of at least ten per cent. on the estimate of 1885.—*Science*, October 5th.

GENERAL.

The Equatorial Limits of Snow.—Dr. Hans Fischer has traced out two limits of snow, the inner showing the lowest latitudes at which as a rule snow falls every winter, the outer or absolute limit, on the Equatorial side of which snow has never been observed. The data employed are the records of Meteorological Societies, where such are obtainable, the reports of travellers, and (for the oceans) the log-books of merchant-vessels. These records are not altogether reliable, but must be corrected by comparing those of places in the same latitude and of similar geographical position, or by a general knowledge of the climate. The errors may be due to sleet or fine hail being distinguished as snow; indeed, snow passes so imperceptibly into sleet and hail that a strict definition of it would be of service. As might have been expected, the coasts are less frequently visited by snow-storms than inland districts, the coasts of the Iberian, Italian, and Balkan peninsulas, for instance, lying between the two limits; while in the interior of these lands snow falls every winter. In the Southern Hemisphere the inner limit runs with slight deviations along the fortieth parallel of latitude, the absolute limit lying about 5° nearer the Equator. Snow also falls annually in the Andes, the southern extremity of South America, and the mountains of Cape Colony and Victoria. In the Northern Hemisphere these lines are not so constant. The inner limit rises to 45° or 46° N. lat. in the neighbourhood of the Bay of Biscay, and descends as low as 26° in Mexico and China. The region of occasional snow is of varying width. To the south of

Europe it embraces the Mediterranean and the North Coast of Africa, while along the Himalayas it is reduced to a very insignificant strip. The limit of annual snow in the Southern Hemisphere passes almost entirely over the ocean, while in the Northern it is forced out of its course by the effects of mountains, prevailing winds, etc. Thus, the Mediterranean Sea keeps it fairly high in Europe, while the cold north winds which blow over Texas bring it down nearly to 30° N. lat., and at the east end of the Black Sea it appears not improbable that a small snowless district exists under the shelter of the Caucasus. On the ocean the limits lie at about 40° and 35° N. lat. respectively ; but log-books do not supply sufficiently trustworthy material, and these lines may therefore need a slight alteration. Dr. Fischer also gives details of the snowfall in Abyssinia, the Sandwich Islands, and other isolated regions. For full information we refer the reader to the original article and map in *Mittheilungen des Vereins für Erdkunde zu Leipzig*, 1887.

Antarctic Regions.—The proposal for a German expedition to the Antarctic Regions, which has been so persistently advocated by Dr. G. Neumayer, and is to be fitted out by Mr. Henry Villard, a German-American capitalist, seems likely to become a reality. It is affirmed that a contract has been concluded with an American firm of shipbuilders for the building of two steamers specially constructed for ice navigation. Among the places the expedition is to visit are the South Shetlands, the South Orkneys, South Georgia, and the Bouvet Islands. —*Globus*, vol. liv. p. 20.

NEW BOOKS.

Les Formes du Terrain ; par G. DE LA NOË, Lieutenant-Colonel du Génie au Service Géographique, avec la collaboration de Emm. de Margerie. Paris : Imprimerie Nationale, 1888. (*Service Géographique de l'Armée*) 4to. 1 vol. Texte, 1 vol. Planches.

This is a very able and interesting monograph on a subject which will never fail to command the attention of geographers and geologists. The origin of the present surface-features of the earth has for many years formed a favourite subject of discussion in this as in other countries, and the part played by the various agents of change in the production of that surface has long been matter of dispute. It is now generally admitted that while some of the most conspicuous features of the land, such as mountains of elevation (although even these have been profoundly modified by superficial agents), are due directly to subterranean action, yet that the general configuration of the surface, the innumerable topographic forms into which that surface has been sculptured, chiselled, and polished, are due principally to the action of epigene agents, conspicuous amongst which is running water. It is the study of these agents of erosion, the laws that govern them, and the forms that result from their action, with which our authors are concerned. The first part of their work is taken up with a statement of the elements and principles of their inquiry. They are of opinion that running water has played the most important *rôle* as a denuding agent, and their reasons for so thinking are given in detail. Their first reason is drawn from the harmony manifested in the general relief of the continents—in the perfect drainage of the surface, and the continuity of the slopes from the water-partings to the coast—in the progressive increase in the size of river-channels, and the ramifying dis-

position of the water-courses in each basin; and in the remarkable correspondence that obtains between the levels of the streams and rivers at their confluence, and between the level of a river-mouth and the sea. Exceptions to these general rules are not forgotten. Thus, in mountainous regions, although the drainage is perfect, yet it is not always accompanied by a continuity of the slopes. Lakes and waterfalls are there of common occurrence. But running water is reducing such inequalities, and the condition of things in mountain-regions corresponds to a less advanced phase of denudation than that which is characteristic of lowlands generally. The authors recognise also that in those less elevated tracts irregularities of slope are not infrequently brought about by the juxtaposition of rocks which do not present the same degree of resistance to denudation. But such cases are, after all, only apparent exceptions to the rule, and afford in reality additional evidence in favour of the potent influence of running water as an earth-sculptor. The second reason advanced by the authors in support of their view that the conformation of the ground (the *surface topographique*, as they term it) is the result of denudation, lies in the fact that the surface very rarely coincides with the upper surface of the underlying strata. Whether we consider the geological structure of plateaux—of regions where the strata are highly inclined, gently inclined, or horizontal—or of mountain-tracts composed of strata arranged in series of well-defined arches and troughs, such as the Jura Mountains, we see that considerable denudation has taken place, so that the plains of bedding or stratification are most frequently oblique to the *surface topographique*. These phenomena lead our authors to think that the chief denuding agent has been running water. A third reason for this opinion is afforded, they believe, by the proved extent and intensity of denudation. We have only to consider the enormous thickness attained by individual series of stratified rocks to be assured of the potency of running water as a denudant. These stratified rocks (many thousand feet in thickness) are derivative—that is to say, they have been formed out of the *débris* of pre-existing rock-masses. In other words, they consist of sediment which has been washed down by running water from the continents to the seas. When, therefore, we encounter a set of strata equalling 20,000 or 30,000 feet in thickness, and covering, it may be, many hundreds of square miles, it is obvious that some land-surface has been denuded to that extent at least. In other words, the volume of the sediments must necessarily correspond to an equal blank or want at the surface of the land which furnished their materials. The authors next proceed to discuss the direct proofs of the excavation of valleys by running water. They refer to the earth-pillars of the Tyrol, etc.; to the occurrence of alluvial terraces on the slopes of valleys; to the appearance of pot-holes and water-smoothed surfaces at various levels above the present streams and rivers; to the damming of streams by lava-flows, and the subsequent erosion of these rock-dams by running water; and to various other phenomena which all point in the same direction. The manner in which rocks are disintegrated is discussed in some detail, the authors in this part of their subject being largely indebted to the well-known labours of the Belgian geologist, E. Van den Broeck. They show how the material resulting from this general disintegration is employed by rain and running water in breaking up hard rocks, upon which pure water would have little effect. The general tendency of rain action is to diminish more and more the inclination of the surface, and this is illustrated by reference to some ingenious illustrations which are figured. But the flattening of the slopes and the smoothing out of the intervening ridges —or, in other words, the modelling of the surface—do not proceed with regularity. The varying consistency of the rocks gives rise to endless modifications

—the slopes produced by this superficial wear-and-tear being independent of the stratification of the rocks below. Some remarks are made on the part played by man in the modification of the surface ; and here the authors might have gathered additional evidence in this direction from Mr. Marsh's work on *Man and Nature*, which they do not appear to have consulted. Although the form of the ground results generally from the superficial erosion of the rocks, yet in many places that form is due to local accumulations of *débris* which are the result of erosion. Our authors next consider the formation of river-channels, and show that pure water alone may cut down into more or less incoherent accumulations, but that to erode a channel in resisting materials, the water must be charged with solid materials. They then discuss the mode in which channels are deepened and widened by the action of flowing water, the forms assumed by such excavated courses, and the laws which govern the deposition of sediment in the beds of rivers. Having considered the mode in which water is employed in modifying the general surface of the land and in excavating channels, our authors next proceed to point out how these two kinds of surface-modification combine to give to valleys the characters which we observe. In this discussion it is shown that the character of the rock-masses, and the mode in which they are arranged—in a word, their varying petrological and structural peculiarities—are all-important in determining the forms produced by denudation. These views are then illustrated by reference to a number of regions, the topographic features of which have been studied in detail by the authors. The general conclusions arrived at do not differ from those which have been long held by geologists in this country, and which in America have of recent years been insisted upon by Powell, Dutton, Gilbert, and others. In the second part of their work MM. Noë and Margerie treat of the causes which have determined the direction in which the waters flow. Here also they follow in the wake of English, American, and certain German writers, amongst whom they acknowledge special indebtedness to A. Philippson. To give even an outline of this part of their subject would occupy more space than we can spare. We can only mention briefly their conclusion, which is, that the general direction of valleys has been determined, in the first place, by the flow of the waters over the surface of the land at the time of its appearance. But the track of the waters and the grouping of the various systems of rivers have been modified by the nature of the subjacent rocks, by climate, and by the degree of permeability of the soil. The general modelling of the continents, therefore, the authors attribute almost entirely to pluvial and fluviatile erosion. They admit, however, that other agencies have been at work in modifying the relief of the land, and in the third part they discuss the action of glaciers, of the waves of the sea and lakes, of wind, and of volcanoes. Each of these agents has had its share in the work of modelling the land-surface ; but however great that share may have been in certain regions, yet it is obvious, they think, that for the continents generally, the work performed by the agents of change referred to was relatively of little importance. The authors, however, have under-estimated the importance of ice as a modifier of the surface. This agent, which has left its impress over the major portion of Europe and North America, not to mention other regions of the globe, can hardly be considered as relatively of little importance. We have given but a very imperfect outline of this interesting monograph. The general argument, as we have indicated, is not new. Geologists here do not need to be converted to the views of erosion first clearly enunciated by Hutton in his *Theory of the Earth*, nearly a century ago, and supported by Playfair in his famous *Illustrations*, published so far back as 1822—neither of which epoch-making works, curiously enough, is mentioned in our authors' list

of the most important treatises dealing with the phenomena of erosion. But our authors are to be congratulated on the comprehensiveness, clearness, and precision with which they have set forth a difficult subject. The work is illustrated by forty-nine plates, which greatly add to its usefulness.

Meyer's Konversations-Lexikon. Vierte Auflage. Band VIII., Hainleite – Iriartea ; Band IX., Irideen—Königsgrün ; Band X., Königshofen—Luzon ; Band XI., Luzula—Nathanael. Leipzig, Verlag des Bibliographischen Instituts, 1887-88.

These four volumes, well printed, well bound, profusely illustrated with both woodcuts and maps, carry the fourth edition of this pattern Encyclopædia down past the middle letters of the alphabet. The publishers deserve hearty congratulations for the way in which they are putting this edition of their great work into the hands of their readers. In the course of four stout volumes, ranging from Hai. to Nat., there are, of course, a great number of articles which invite us to pause and say a few words about them ; but we can only concern ourselves in this place with those articles which are of geographical interest. And of such articles there is an abundance to choose from. In a German encyclopædia it is, of course, but reasonable that those features should be predominant which are specially interesting to the German reader.

The article, however, to which the reader of this Magazine would, we believe, turn first, is Ireland. In the space of some twenty-eight columns of closely-printed text we have an admirable account of our sister island, its geography and its history, the information being, so far as we have tested it, accurate and up to date, the leading facts raised in due relief and set off by an appropriate grouping of subsidiary items of knowledge. The sketch of the Irish national character, though terse, is clearly drawn. The movement and tendency of the different branches of agriculture are duly pointed out, namely, the substitution of grazing for arable land, the steady diminution year by year in the number of acres devoted to agricultural purposes, the growth of forest lands, and the rapid increase in the extent of area going out of occupation. Considerable space is occupied with the recent deplorable history of the island. A neat little article on Colonies and colonisation is accompanied by valuable tables of statistics, drawn up in such a way as to show the comparative position and importance of the colonies of the seven chief colonising nations of Europe, as well as by maps which have been designed with the same end in view. From these last we see that in point of area, next after the British, it is the French, Portuguese, Danes, and Dutch who rank, along with the Germans, as the largest owners of colonial possessions.

One of the most valuable articles in these volumes is that on the Ocean. It handles the subject in sections devoted to the depths of the different oceans, the chemistry and physics of the sea-water, the currents, the ocean waves, the marine flora and fauna, and the configuration of the sea-bottom. It has appended to it a useful table of greatest depths, telling us the precise localities of the soundings, by whom they were made, and in what year. The work of the "Challenger" expedition does not, however, seem to have received that attention from the writer of the article which from the intrinsic nature of the published reports it should have received ; at all events he does not cite the publications of the Commission, and only alludes to them indirectly, if it is to them he does allude. The subject of Agriculture, though not technically belonging to the domain of geography, may yet be briefly mentioned, some forty columns being

set apart for the treatment of its various branches. Another very interesting article is that on Commercial Geography, the nature and scope of which department of geographical knowledge are described in a clear, comprehensive, succinct manner, the science being carefully discriminated from Industrial Geography on the one hand, and from Political Economy on the other. The passages in the article *Hansa* (Hanseatic League), which deal with the relations of the League with England, and its rivalry with the Merchant Adventurers' Company, are well put, and to the point.

The maps of this Encyclopædia form, to our mind, one of its most useful and valuable features; and we apply our remark not only to the maps of the countries and provinces, but also to the plans of large towns, both German and foreign, and the small maps of the environs of such as possess sufficient importance to be illustrated in this way. Amongst those which particularly call for mention are the maps of the Harz Mountains (geological), Italy (geographical and historical), Hanover, Hesse, Further India (though the colouring is not quite so satisfactory in this), Carinthia, the Russian Baltic Provinces (Livonia, etc.), Cape Colony, Mexico, Mediterranean Sea (several useful inset maps), Massowah, etc.; and the town-plans of Hamburg (also one of environs), Jerusalem (modern town), Kairo (with plans of pyramid groups), Köln (Cologne), Königsberg, Constantinople and the Bosporus, Leipzig (also two maps to illustrate the battle-fields of 1813), Liverpool, London (two), Messina (Straits of), Metz, Lübeck, and Lyons. The most tasteful of all are perhaps those of Mainz (Mayence) and Milan. Many of these town-plans are accompanied by keys to the principal streets and public buildings, and so forth, and are as serviceable as the maps published in the orthodox guide-books.

Venezuela, von Dr. W. Sievers, Docent an der Universität Würzburg. Mit einer Karte der Venezolanischen Cordillere, bearbeitet und gezeichnet auf Basis der Sievers'chen Forschungen von L. Friederichsen. Hamburg: L. Friederichsen and Co., 1888. Pp. viii. and 359.

This is a companion volume to the author's work, *Die Cordillere von Merida* (already reviewed in this Magazine, vol. iv. p. 505), and, like that, characterised by the same excellent qualities,—a thorough grasp of the subject, conscientious and painstaking care, an easy command of details, a clear and plastic style, natural consecutiveness in the logical structure of the narrative, admirable powers of description, culminating in a graphic and useful account of the land and its physical features, its productions and its inhabitants.

The writer begins with a rapid sketch of the broad general structural features of Venezuela, pointing out how it embraces parts of the three great types of South America,—viz., the Cordilleras, the Llanos, and the archaic *massif* of the eastern side of the continent. This general survey of the physical features of the country is followed immediately by an equally rapid sketch of its history, from the time of the first appearance of the Spaniards down to the restoration of order and settled government, and the revival of prosperity, under the administration of President Guzman Blanco. The plan of the book is not framed altogether upon the lines of the author's itinerary, though such an intention seems to have been, to some extent, present in his mind. Whenever he finds it convenient, he turns aside to give a compact excursus, mostly in a single chapter, on some outstanding feature of geographical interest connected with the country, such as its Climate, Lake Maracaibo, the Cordilleras, Agriculture, Vegetation, the Paramos, the Llanos, the Customs and Manners of the People, the Caribbean Mountains, and the Present Condition and Circumstances of the Republic.

By the Paramos are meant those bare, barren, wind-swept plateaux which range above the highest level of arboreal vegetation up to the lower limits of snow. They are thus the coldest and most inhospitable regions of the mountains. Those which lie highest are quite destitute of vegetation; but those which border on the limit of arboreal vegetation are, as a rule, covered with grasses and Alpine plants. These tracts are greatly feared and shunned by the native population on account of the cold, deaths from starvation being not uncommon; and it is not only men, but animals and birds also that are sometimes frozen to death whilst crossing them. The fatal result is owing mainly to the violent change in temperature between the plains (the *tierra caliente*) and the mountains, but also in part to the keen cutting winds by which the Paramos are swept. Moreover, the atmosphere at those altitudes is in general thick and heavily laden with moisture, which again helps to intensify the difference between the plains and the mountain plateaux.

In the interesting chapter on the Llanos (or savannahs), Dr. Sievers offers a contribution to our knowledge intended to supersede the account of Humboldt, and to supplement that of Dr. C. Sachs. Humboldt's description is no longer correct, for the face of the llanos has greatly changed since his day. Instead of being one ocean-like expanse of grass, unbroken by tree or shrub, and covered with innumerable flocks and herds, it presents now a very variegated picture: the immense herds have in great part disappeared, the limitless plains are dotted with thickets and belts of forest trees, and the grass is long and tall—as tall as a man on foot, or even taller. Dr. Sievers believes that in Tertiary times these llanos were covered by the sea, which penetrated right up to the foot of the Cordilleras, and that those ranges had an elevation of some 7000 to 10,000 feet above that to which they rise at the present day. He claims to supplement the work of Dr. Sachs, in that he himself visited the western and less accessible portions of the llanos, and traversed them in the direction of their maximum length, whereas Dr. Sachs (and Humboldt too) crossed them from north to south and confined their travels to the eastern and central parts—the parts which are best known and oftenest visited.

We have only left ourselves room to add that the excellent chapter on the present condition of the country is crammed full of useful information, not neglecting statistical facts down to the most recent years. A great change for the better has come over the land during the years of Guzman Blanco's rule; more especially the advances during the last five years have been much greater and much more important than is generally believed. Nevertheless the work that has to be done in the way of progress before the republic comes abreast of the most civilised European States is truly herculean, and one that no doubt will task all the energy and enterprise of the best men the State can produce for years to come.

France as It Is. By André Lebon and Paul Pelet. Translated by Mrs. William Arnold. London, etc.: Cassell and Co., 1888. Pp. viii. and 348, with three Maps. *Price* 7*s.* 6*d.*

A work which endeavours to give to the dwellers in one land, a fully outlined and vivid sketch of another land, its physical features, inhabitants, constitution, and condition, comes fairly within the scope of geographical study in the wider sense: and it is a duty—and a pleasant duty—for a Geographical Magazine to welcome this well-planned and well-executed work on France. It has been specially written for Englishmen by a Professor of the School of Political Sciences at Paris, assisted by one of his colleagues, and it has been most excellently

rendered into English, so that in style there is hardly a sentence or turn of expression (unless it be in once referring to statutes as *texts*, and using *preoccupations* once or twice for prejudices), which would lead one to suspect that it was not written by an Englishman for Englishmen. It is not all equally easy reading; the systematic description of the coasts, plateaux, mountains, and rivers of France is inevitably not so entertaining as the sketch of the origin, national, racial, and provincial character of the people—not forgetting the ten millions of French-speaking men and women outside France and French Colonies, in Belgium, the Prussian Walloon Country, Louisiana, the basin of the Plate, and in the British possessions, such as Canada, Mauritius, Trinidad, Dominica, St. Vincent. Few Britons will fail to learn much from a chapter on political France, which seems to contain just what on this head Britons should wish to know; and few such will rise from reading the short but pregnant sketch of French Constitutional history, which emphasises both the notable similarities and greater contrasts between the development of things on opposite sides of the Channel without being forced by self-examination to clear up his ideas on many points of the British Constitution. The endless multiplicity of the administrative system is expounded with much fulness and lucidity; in the chapter on Ecclesiastical France we are enabled to understand the bitterness of feeling that still obtains between clericalism and its opponents. Intellectual France is laid bare in the ramifications of the educational system—primary, secondary, higher, and professional. The chapter on Military and Naval France is a valuable compendium for reference; and that on Legal France seems almost too detailed, though the sketch of the general principles of French law is very readable and instructive—as in pointing out that a French father can commit his son to prison for some months. It depends on the nature of the case that the discussion of Economic France—employments, agriculture, property, manufactures, wages, finances, debt,—though one of the most valuable parts of the book—is so full of figures as to be somewhat forbidding in aspect. Colonial France is viewed in an optimistic light, drawn largely from the unquestioned and brilliant success of France in Algeria; though Algeria is treated as, physically even, rather an outlying part of the mother-country than a colony. The author puts this so strongly as to affirm that there is a less sharp contrast between Provence and Algeria than between Provence and Northern France, and that Europe may be said "to end at the sunburnt walls of the Cévennes." It is well known that many have sought European affinities for the Berbers or Kabyles; but we are puzzled by an unsupported statement that the "peasants of the Cévennes appear to possess a prehistoric community of origin with the Mahometan Berbers." Why the peasants of the Cévennes only? In virtue of her African domain, increased largely by Savorgnan de Brazza and the Congo Conference, France claims to be the greatest African Power, even without taking into account her influence in Egypt. The only portions we could wish to have been other than they are, are in the otherwise excellent chapter on the relations of France and England. No fair-minded Briton would object to a record of grievances France has had to sustain at the hands of England, both during the Hundred Years' War and since, or deny that in depriving France of her American and Indian Empires, Britain exacted a severe penalty from France for provocation given nearer home. But readers of the *Expansion of England* will be surprised that the author of the work before us is unable to guess why England went to war with France in 1793, and gives as one feasible explanation that "she hoped to deprive France of the scattered French Colonies still left." France's treaty-rights in the Newfoundland fisheries are said to be systematically infringed "by underhand methods." It is

apparently accounted a crime on the part of Britain to have "looked on with almost absolute indifference at the disastrous war of France against Germany" (whereas in Germany the sin usually imputed to us is active and unnatural sympathy with France). And there is actually a section headed "Regrettable animosity still shown to France," in which British disapproval of the high-handed French proceedings in Madagascar, and British efforts to persuade France not to exercise "her incontestable right of sovereignty" in establishing and maintaining depots of the worst types of criminals within easy access of the Australian Colonies, are set down apparently to mere unjustifiable and unaccountable ill-will. Our position in Egypt is attributed, not to pure "animosity," but to the more intelligible motive of commercial jealousy and ambition. But save in this part of the work, which seems distinctly one-sided in not a few statements, the book will be a most interesting and valuable addition to any library.

The Life and Opinions of Major-General Sir Charles Metcalfe MacGregor, K.C.B., C.S.I., C.I.E., Quartermaster-General in India. Edited by Lady MacGregor. In two volumes. Portrait, Maps, and Illustrations. Edinburgh: William Blackwood and Sons, 1888. *Price* 35*s*.

This is emphatically a soldier's book for soldiers, but also for geographers. From the time he was sixteen to forty-six, when incessant toil and hardship carried him off, Sir Charles MacGregor delighted to fight and to plan fights, and always against Russia beyond the north-west frontier of India. Those who approve of the forward policy which led the country into two Afghan wars will delight in this secret and military history of the second, and of the confidential book, *The Defence of India*, which caused such a scare when a London newspaper began to publish it. Those who disapprove of the policy of Lord Salisbury and Lord Lytton in Afghanistan will find ample justification for their opinion in the second volume. Our duty here is to thank Lady MacGregor for giving us her husband's letters on his great geographical works and explorations. His *Gazetteer of the North-West Frontier*, when, in 1870-72, its massive volumes secretly appeared, with "confidential" printed in red ink on the title-page of each, was the splendid result of personal toil for years, keen intelligence, strategic instinct, and almost reckless daring. Our Frontier, Afghanistan, Persia, and Asiatic Turkey and the Caucasus, from his own pen, besides Kashmir, Bokhara, and Khiva, written by others under his guidance, for the first time gave the responsible authorities at Calcutta and the India Office the knowledge from which all subsequent defensive action has come. Happy the few possessors of these volumes outside of official circles (like the present writer)! MacGregor's first journey in 1875 through Persia towards the northern confines of Afghanistan, and his subsequent marvellous exploration, with Captain Lockwood, of the approaches from Eastern Persia to India, laid the seeds of that disease to which he succumbed in 1887. We first stumbled upon him in the thick of the Bengal famine of 1874, when he organised the transport arrangements which reduced to manageable proportions the "famine which threatened to carry off thousands, if not millions, of its inhabitants," as Sir Frederick Roberts declared, when unveiling his picture last May at Simla. The Highlands of Scotland never produced a more daring and toiling soldier than this descendant of Rob Roy Macgregor. As a geographer, he wrote the best description of himself when, having ridden out across the Hari-rud in the endless desert in the direction of Merv, he remarked: "Deserts have the same effect on me as unknown mountain ranges—I always want to look beyond!"

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THE ANDAMANS AND ANDAMANESE.

(*Read at Meeting of Society, Edinburgh, 15th January* 1888.)

By Colonel T. Cadell, V.C.,

Chief Commissioner of the Andaman Islands.

The Andaman Islands are situated in the Bay of Bengal, and Lord Mayo was murdered there in 1872. That is probably all that most of my hearers know about them, and I confess I did not know much more when the appointment of Chief Commissioner of the islands was conferred on me nine years ago.

Until within the last hundred years the Adamans were almost *terræ incognitæ*, although they were mentioned by an Arabic historian in the ninth, by Marco Polo in the thirteenth, century, and by several ancient voyagers. There has been much speculation as to the origin of the name "Andaman." Colonel Yule states that "Angamanain," the name used by Marco Polo, is the Arabic dual of "Angaman," the origin of which name may be traced to Ptolemy's reference to these islands as the *Insulæ Bonæ Fortunæ;* in Greek, *ἀγαθοῦ δαίμονος*, which might easily be converted into "Agdaman" or "Andaman." But a more probable derivation of the name is that it comes from "Hanúmán," the monkey god of the Hindus. The islands are to this day called by the Malays "Pulo Handúmán," "Pulo" meaning "islands," and Handúmán being their mode of pronouncing the name of the Hindu deity; and a very slight change of pronunciation turns "Handúmán" into "Andaman." There are, as a matter of fact, no monkeys in the Andamans, but the Malays, who, it is believed, were in the habit in ancient times of visiting the islands for the purpose of obtaining slaves, edible birds' nests, and *bêche-de-mer*, the sea-slugs beloved of the Chinese, may have seen in the aspect of the pygmy inhabitants a resemblance to the monkey god, and have given his name to the islands.

GEOGRAPHICAL.—The main group of the Andamans, which consists of the Great Andaman, and is divided by narrow straits into three islands, the North, Middle, and South Andamans, is situated between the parallels of 11° 25′ and 13° 35′ of north latitude, and just west of the 93d meridian east of Greenwich. It is about 140 miles in length, with an average breadth of about 10 miles. On the east side are the islands known as the Archipelago, and named after the heroes of the Indian Mutiny, Outram, Ingles, Wilson, Lawrence, Havelock, Nicholson, Neil, Rose; and on the west are the Labyrinth Islands, none of which are inhabited. The total area of these islands is about 2500 miles, about four-fifths of which is comprised in Great Andaman.

About 50 miles south of the main group, and connected with it at short intervals by the Cinque and other small uninhabited islands, is Little Andaman, 27 miles long by about 15 broad, about which very little was known until recently. I shall say something about this island further on.

The Andamans, together with the Coco and Preparis Islands to the north, and the Nicobars to the south, are a portion of the volcanic chain, some 2000 miles in length, which extends from the south-west point of Arakan to Sumatra, and thence on to the Sunda Islands, where the eruption of Krakatoa took place in August 1883. The effects of this eruption were felt at Port Blair, 1500 miles distant. On the day following three great tidal waves rose and fell there, and sounds, so like the firing of big guns, were heard, that it was thought that a man of war had got ashore on the west coast of South Andaman; and the station steamer was sent out to look for it.

In the above enumeration of islands I have omitted to mention Barren Island, containing as it does a very interesting volcano, and Narcondam, regarding the former of which I may have something to say if time permits.

All the Andaman Islands, excepting an area of about 20,000 acres, which have been cleared by convict labour in the vicinity of Port Blair, are covered with primeval forests, which come right down to the water's edge, and there is hardly a level spot to be found on the whole of them, excepting, of course, the mangrove swamps, which have been reclaimed between high and low water. The chains of hills generally run north and south, and the principal peaks are Saddle Hill, 2400 feet high, in North Andaman; Mount Koyob, 1600 feet, and Mount Harriet, overlooking Port Blair, 1200 feet, in South Andaman; and Ford's Peak, 1400 feet, in Rutland Island. The first of these, Saddle Hill, has been spoken of as a sanatorium for the troops in Burma, but the ascent is very steep, and there is no water within 1000 feet of the top. On Mount Harriet there is a small sanatorium to which the residents of Port Blair occasionally betake themselves.

GEOLOGY.—The rocks are composed principally of sandstone, probably of the Tertian age, serpentine, and limestone; and in places beds of volcanic origin are found. No minerals of value have as yet been discovered, excepting iron and copper pyrites, which cannot be worked to advantage.

It appears to be an accepted fact that the islands are undergoing subsidence at a very slow rate. This is proved by the stumps of forest trees, which must have grown above high-water mark, being now found in many mangrove swamps; and the mangrove, requiring as it does alternately salt water and fresh air at its roots, only grows between high and low water, on ground laid bare by the receding tide.

Forests.—The forests contain many valuable woods, the most valuable of which is padouk (*Pterocarpus dalbergioides*), a hard red wood resembling mahogany, which takes a beautiful polish. A late Deputy Conservator of Forests estimated the value of this one description of timber in the Andaman forests at two millions sterling. In 1884 a consignment sent to London fetched £13, 10s. a ton, but the price has since fallen to £7 or £8 a ton; and few purchasers have as yet been found for a cargo of nearly 600 tons, which arrived in London a few months ago. The wood only requires, I am sure, to become known in this country to find a ready sale. The forests only bring in a revenue of about Rs. 50,000 a year at present, but they are being developed, and a larger income may shortly be expected from them.

Harbours.—The coasts on both sides of Great Andaman are indented by numberless bays, some of which afford safe anchorage, but the only two really good harbours are Port Cornwallis and Port Blair, both magnificent harbours, capable of affording accommodation to the largest fleets. Situated in the centre of the Bay of Bengal, they are excellent havens of refuge. It would be easy to construct docks of large size at Port Blair, and such are much wanted in the East Indies, there not being one capable of receiving a large ironclad east of Malta. But docks require plant—indeed an arsenal with fortifications, and a garrison to protect it—and the Government of India is not prepared to undertake the original outlay and permanent expenditure which would be entailed.

Scenery.—It is beyond my ability to describe the lovely scenery through which one passes when sailing among the islands, covered as they are with luxuriant vegetation down to the water's edge. It is like fairy-land—the water deep and clear as crystal—on either side, within a stone's throw almost, magnificent forest trees reaching to a height of 200 feet, the stems of some straight and white, like gigantic silver rods, with umbrella-like tops—others clothed from foot to summit with creepers in beautiful festoons—palms, rattans, and canes of many varieties interspersed among the forest trees, creating striking contrasts of form and colouring; while beneath the vessel are seen inconceivably beautiful coral gardens. The prevailing colour of the living corals is white, and they also exhibit many shades of buff, pink, blue, their branches tipped with a magenta-like bloom, and sometimes with white, like the polished antlers of stags. The variety of form of the different kinds of coral is even greater than that of their colours. And life is given to the scene by the brilliant-hued fish which dart about among the coral trees. Well did

one author write that he was "quite unable to attempt the task of describing, much less conveying an adequate idea of, the exquisite assortment of colour, of the varied forms of life, which are included in every square yard of these tropical submarine gardens." The most gorgeous combination of vegetable and animal life afford but a poor sub-aërial representation of these submarine gardens. Unfortunately the corals of this region are of no marketable value, as, when removed from the sea, the insects which supply the colour die, the colour consequently disappears, and the substance left is very fragile. The only use which we are able to make of the coral is in the manufacture of lime.

Climate.—The climate of the Andamans is very equable, and the temperature is much the same all the year round, the thermometer in the shade varying between 91° and 67° Fahrenheit, and Europeans can go about all day long without paying the respect to the sun which they have to do in India. The rainfall averages about 123 inches in the year, and falls between the months of May and December—January, February, March, and April being the only months which are generally rainless. The rains come in about the beginning of May with the south-west monsoon, which lasts until pretty far on in September, when the north-east monsoon sets in, bringing with it during the succeeding three months somewhat less heavy rain than the other monsoon.

The rain generally falls propitiously, and though one may generally bargain for a ducking during one's morning ride or sail throughout the rainy season, we are disposed to grumble if it prevents lawn-tennis being played on our asphalt courts on two successive evenings, so, notwithstanding our heavy rainfall, we are not much to be pitied.

Cyclones.—It has been clearly proved that the cyclones which cause devastation in the northern portion of the Bay of Bengal, are formed in the vicinity of the Andamans, and that if there were telegraphic communication with Port Blair, much loss of life and property would be saved. An impoverished government, however, has not yet been able to afford the £78,000 which a cable between Port Blair and Diamond Island, at the southern point of Pegu, would cost, and the annual expenditure for its upkeep. We hope in time to have it, however.

To return to the subject of cyclones, although they are formed as just mentioned in the neighbourhood of the Andamans, they very seldom visit the Islands themselves, only one in 1864 being on record. A curious coincidence happened in, I think, 1845, which may interest those who have not heard the story before. Two ships, named respectively the *Runymede* and the *Briton*, sailed, the one from Sydney, the other from Portsmouth, each with a wing of the 80th Foot on board, bound for Rangoon. They were caught in the same cyclone some distance to the east of the Andamans: both ships were carried by a storm wave right over a mangrove swamp, and when daylight broke the two ships found themselves high and dry on the beach of Havelock Island within a mile of each other, a curious place for the wings of a regiment to rendezvous at. Not a life was lost.

Aborigines.—It is now time that I should tell you something of the inhabitants of the Islands. They have always had an evil reputation, which I do not think they deserved. Professor Flower, in a very interesting lecture which he delivered six or eight months ago, quoted an Arab writer of the ninth century, who wrote that "their complexion was frightful, their hair frizzled, their countenance and eyes frightful, their feet very large and almost a cubit in length, and they go quite naked;" and Marco Polo, writing in the thirteenth century, states "the people are no better than wild beasts, and I assure you all the men of this Island of Angamanain have heads like dogs, and teeth and eyes likewise; in fact, in face they look just like big mastiff dogs." They have always had an ill name as cannibals, and this is probably due to the ferocity with which they attacked all strangers who approached their shores, and small blame to them, as their hostility is due to the treatment which they received from the Malay and Chinese traders who visited the islands in search of *bêche-de-mer* and edible birds' nests, and who, when opportunity offered, carried the natives off into slavery.

We have now acquired an intimate knowledge of the inhabitants of the principal group, and it has been established to our satisfaction that they were never given to eating each other or even strangers. They themselves utterly repudiate the idea, and the injustice of the accusation is proved by the fact that of the many convicts who have escaped into the forest from the penal settlement at Port Blair, none are known to have been eaten. Many of those runaways have died of starvation and exposure, and others who tried to bully the natives or resisted capture have been shot by them, and the bodies of such men, whenever they have been found by people from the settlement, bore no evidence of having been mutilated or dishonoured. It is our invariable experience that when runaways do not offer resistance, they are brought in by the natives, who are rewarded with a good feed, which the Andamanese Homes, of which I shall speak presently, can afford to give, as the sum of five rupees is paid for every escaped convict who is recaptured.

Far from possessing the horrible appearance ascribed to them in the above quotations, the Andamanese are not at all disagreeable to look at. Although not classically beautiful, and some of them are decidedly ugly, both men and women have smiling, innocent faces, and are pleasant to look upon. The men are well-made, dapper little fellows, their average height being 4 ft. $10\frac{3}{4}$ in., and the women, whose average height is three and a half inches less, although their figures are not graceful, have also pleasing, innocent-looking countenances.[1] In place of the enormous feet ascribed to them by the Arabic writer, their feet are generally small and well shaped, with no

[1] Since writing this lecture I have seen in *The Times* of the 11th instant the notice of a lecture delivered by Professor Flower, in which he states that the average height of the males is 4 ft. 9 in., and of the females, 4 ft. 6 in. He has doubtless calculated this average on the skeletons in his possession, but the averages mentioned by me are based on the measurements of 48 men and 41 women, carefully taken by Mr. E. H. Man, First Assistant Superintendent at Port Blair, whose patient researches into everything concerning the natives are embodied in the interesting monograph from which some of the information contained in this lecture is derived.—T. C.

sign of the projecting heel of the Negro races. Although their crania have a marked resemblance to each other, proving them to be an unmixed race, there is almost as much variety of countenance among them as among us. No Negro, however, is blacker than an Andamanese, the hue of whose skin has been likened to a stove well polished with black lead; but the protruding lips and broad flat nose of the Negro are non-existent among them, although Professor Flower, who has exhaustively studied the skeletons which have been sent to him, states that in the relative proportions of the limb bones, Negro affinity is most strongly indicated. They have, moreover, none of the disagreeable exhalations of the Negro, and I can testify, after much experience, that they are quite pleasant neighbours even in a tightly packed boat. I must admit, however, that when they are permitted to indulge in their proclivity for smearing themselves with pig and turtle fat mixed with red oxide of iron, their proximity is not so agreeable.

In the absence of all historical record, it is, of course, impossible to tell the origin of this primitive race. Professor Flower wrote some years ago, "It is very possible—but this is purely hypothetical—that the Andamanese, whose geographical position is almost midway between either extremes of the range of woolly-haired races, may be the unchanged or little modified representatives of a primitive type from whom the African Negroes on the one hand, and the Oceanic Negroes on the other, have taken their origin." They are still in the stone age, and their long isolation constitutes in them a most interesting study for the student of ethnological history. They are said to be closely allied to the Negritos of whom remnants are found in the Philippines, Borneo, and some other islands in that region; and Professor Flower considers it unquestionable that this race has contributed to the population of New Guinea. Traces of them are also to be found in the interior of the Malayan Peninsula, and Quatrefages is of opinion that among some of the lowest and least civilised tribes of India, frizzly hair, Negro features and small stature are so common, that a strong argument can be based on them for the belief in a Negrito race forming the basis of the whole pre-Aryan population of the Indian Peninsula. Professor Flower considers the Andamanese the least modified representatives of the primitive inhabitants of a large portion of the earth's surface, and they are now verging on extinction. Year after year, in my cruises among the islands, I see a perceptible diminution in their numbers, the principal causes of which are, apparently, syphilis and pneumonia. Hardly one woman in a dozen bears children, and the mortality is very great among the few children that are born. It is undoubtedly a moribund race, and probably none of them will be found alive some twenty-five or thirty years hence, except, perhaps, in Little Andaman, where the inhabitants have been kept free from the dire effects of contact with civilisation.

They are such jolly, merry little people, and it is very saddening to live among them and realise that they are so fast dying out. You cannot imagine how taking they are. Every one who has to do with them falls in love with them. One of the officers of the Commission is always placed in special charge of the Aborigines, and it has happened more

than once, that when I have had occasion to allot this work to a fresh officer, he has come to me and asked to be let off, as he took no interest in the little beggars; but it has, also, always happened that when this officer has subsequently been ordered to give them up, he has begged me not to deprive him of the charge.

They have always been kindly treated by us, and there is a strict order against giving them spirits—glad as the poor little fellows would be to get them. It took several years after the settlement at Port Blair was founded before we were able to establish friendly relations with the natives in the immediate vicinity. They naturally resented our intrusion, and the establishment of those friendly relations was due to a most worthy old officer, Mr. Homfray, who devoted himself with heart and soul and purse to their reclamation. His influence gradually extended over South and thence over Middle Andaman, but it was not until after my advent that satisfactory relations were established with the natives of North Andaman, and it has only been within the last year or two that we have been able, through the exertions of Mr. Portman, supported by myself, to make friends with the inhabitants of Little Andaman.

A great institution at Port Blair is the Andaman Homes. The Government of India grants Rs.200 a month towards their upkeep, and this sum is doubled by the sale of shells collected by the inmates of the Homes, and of bows and arrows and ornaments made by them. This fund enables us to feed all the natives who visit the settlement, some of whom it is necessary always to keep handy for the pursuit of runaway convicts, and the fund also enables us to purchase beads, looking-glasses, pipes, tobacco, and other things which they covet.

It is entirely by kindness and liberality that we have succeeded in gaining the affections of all the inhabitants of Great Andaman, excepting the Járáwas, a wild tribe, between whom and the friendly natives bitter feud exists. In appearance they are much the same as our friends, but they speak a totally different language, and their customs differ in many details, as do also their bows and arrows in shape. These Járáwas fire at us whenever they have a chance, and a year seldom passes without some convicts being shot by them. We have occasional little expeditions against them, and succeed in capturing a few women and children, and, more rarely, an adult male or two. Our method is to keep those captives with us for some time, and, after treating them with the utmost kindness, to send them away loaded with as many presents as they can carry, but as yet this has had no effect in reconciling them to us.

Another of our institutions is the Andamanese Orphanage, for which an allowance of Rs.100 a month is granted. This establishment is generally in charge of the Chaplain. The children are taught reading, writing, and arithmetic, and are very quick at the uptake, as we say in Scotland, till the age of fourteen or so, when they long for the freer life of their ancestors, and speedily revert to their savage ways. Every endeavour is made to instil into them the doctrines of Christianity, but the result has been utter failure. They learn by rote the Lord's Prayer, the Creed, and the Ten Commandments, and can answer simple questions in Bible history, but the truths of Christianity produce no impression on

their hearts, and the tenets of our religion appear to be quite beyond their comprehension. Even when young, the slightest restraints of discipline are irksome to them, and desertions from the Orphanage are frequent. One morning, for example, the Orphanage, which was then situated on Ross Island, was discovered to be empty. The boys, about twenty in number, and varying in age from five or six to fourteen, had all disappeared, and when they were recaptured a day or two afterwards, they confessed to having swum across the harbour, a distance of two miles. They stated that when any of the smaller boys got tired on the way over, they rested on the backs of the bigger ones.

Contact with civilisation has not improved the morality of the natives. In their natural state they are truthful and honest, generous and self-denying. I have watched them sitting over their fires cooking their evening meal; and it is quite pleasant to notice the absence of greed and the politeness with which they pick off the tit-bits and thrust them into each others' mouths.

The forest and sea abundantly supply their wants, and it is therefore not surprising that our attempts to induce them to take to cultivation have been quite unsuccessful, highly though they appreciate the rice and Indian corn with which we occasionally supply them. All is grist that comes to their mill in the shape of food. The forest supplies them with edible roots and fruits. Bats, rats, flying foxes, iguanas, sea-snakes, molluscs, wild pig, fish, turtle, and last, though not least, the larvæ of beetles, form welcome additions to their larder. I remember landing one morning by chance at an encampment of theirs under the shade of a gigantic forest tree. On one fire was the shell of a turtle acting as its own pot, in which was simmering the green fat, delicious to more educated palates. On another its flesh was being broiled, together with some splendid fish. On a third a wild pig was being roasted, its drippings falling on wild yams, and a jar of honey stood close by—all delicacies fit for an alderman's table.

I may here mention that they do not catch fish with the net or line, but shoot them with arrows, and wonderful shots they are. The way in which they transfix fish darting along at full speed in shallow water is marvellous.

They do not turn turtle, but spear them; and it is a sight to see a pygmy, standing on the prow of his boat, fling his spear with unerring aim, plunge in after it, and catch hold of the turtle by the shoulders. The turtle darts off at lightning speed below water, but the pygmy does not release his hold, and soon brings him to the surface.

The natives live happily together in small encampments, more than thirty or forty people seldom living in one cluster of huts. Their dwellings are simply lean-to huts, built of branches and leaves of trees; they frequently change from place to place for sanitary reasons, or when game and other food become scarce in the vicinity—or when a death takes place in the encampment. They have no hereditary chiefs. The strongest character becomes a leader, and exercises influence for a time.

They have no form of worship or religious rites. They generally

bury the dead, but a more honourable mode of sepulture is to place the corpse, wrapped up in large leaves, on a stage made of sticks and boughs fastened together, in the forked branches of a tree eight or ten feet above the ground. On a death occurring in a family, the immediate relatives cover themselves with white clay, and during the period of mourning they abstain from pork, turtle, and certain other delicacies. After a time they return to the deserted encampment and exhume the remains, or take them down from the stage, and after cleaning the bones, carry them about as ornaments.

The men wear no covering of any kind, unless the armlets and garters which I shall show you can be called such, and the girdle and ornaments made up of *Dentalium octaganum* shells. The women wear girdles made of bark round their waists, to which is attached a scanty leaf-apron in front, and a dress-improver behind. The women's heads are always kept shaved, but the men either allow their hair to grow according to Nature's sweet will, or shave and cut it in fantastic shapes, the most fashionable style being to shave the top of the head, leaving a fringe of hair round it. The women act as barbers, and for razors they use flakes of quartz or broken pieces of glass bottles. I may here mention that the hair of the Andamanese is frizzly, and grows in spiral tufts from the roots, but when the epidermis of the skull is examined with a magnifying-glass, it is found that the roots are evenly distributed over it.

The men are tattooed over the arms, body, and legs, down to the knees, in neat patterns, each tribe being marked in a different manner. No pigment is used in the tattooing, but the skin is cut and raised with the sharp points of broken glass or quartz; the cicatrices caused thereby never disappear. Both men and women have a horrible custom of smearing themselves with "koyob,"—that is, turtle or pigs' fat mixed with oxide of iron, and on gala occasions they adorn themselves with fantastic devices in white chalk.

I spoke above of their being merry and light-hearted. They are much given to dancing, and frequently keep it up all through the night. The women do not join in the dance, but squat on the ground, while the men dance in front of them, time being kept by one man beating with his feet on a sounding-board, and by the women clapping their thighs and singing a chant.

They have two kinds of fairly well-made dug-out canoes, one with and the other without out-riggers. The natives paddle in them along the shore, and in the numerous creeks and straits, but they have never undertaken voyages in the open sea. These canoes go through surf in which our ships' boats would certainly perish, but it is impossible to propel them swiftly, and how one writer on the Andamans witnessed a dug-out beat a captain's gig is beyond my comprehension. The natives are very expert swimmers, and never tire in the water, as you may have inferred from my story of the Orphanage boys swimming across the harbour.

Before concluding my description of the Andamanese, I may tell you of the curious ideas which they have of the sun and the moon. They believe that the former is the wife of the latter, and that the stars, which

are of both sexes, are their children. The sun, they say, is like fire and covered with thorns; and the moon is white skinned, and has two long tusks (the horns of the crescent moon) and a big beard. Their home is beneath the eastern horizon, and the sun after setting rests there till dawn, but the moon is obliged by the cares of his numerous family to keep irregular hours. This statement is taken from Mr. Man's interesting monograph on the Andaman Islands.

I regret I have not time to explain to you their ideas of the creation. (If they have any idea of a future state, which I doubt, it is, that it is like the present one.)

Little Andaman.—I shall now proceed to tell you something about Little Andaman, the inhabitants of which island, until quite recently, fiercely attacked all outsiders who landed on their shores. Perhaps the following extract from a report of mine, written in 1885, will give you as good an idea of the state of affairs as anything which I could write now :—

"Nothing can be more unsatisfactory than our relations with the inhabitants of this island, and they have never been otherwise. Situated not far off the course taken by ships trading with Burma, certain death would await the crew of any ship wrecked on the coast, or any boat's crew who, in ignorance of danger, landed there.

"In 1867 a boat's crew from the ship *Assam Valley* was murdered on the south coast. A small expedition was sent to punish the savages, and it resulted in a lieutenant being drowned, and two men on our side being wounded; several of the islanders were reported to have been killed and wounded, but this is doubtful.

"In 1873, five out of seven of the boat's crew of a Burmese craft, who landed on the east coast for water, were murdered. General (now Sir Donald) Stewart at once sent down a punitive expedition under Captain (now Colonel) Wimberley. That officer burnt six of their large huts, and several of the islanders who attacked him were killed, while on our side two men were wounded. Shortly before this General Stewart had visited the west coast of the island, with the view of showing that our intentions towards the people were friendly. After landing presents at several places, one of his parties were attacked, and in the skirmish which ensued, one of the aborigines was wounded. He died while being taken off to the ship.

"In 1880 I visited the island several times, and all my friendly overtures were rejected. One evening they placed an ambuscade at the mouth of a creek up which I had rowed, and on our return they saluted us with showers of arrows.

"On another occasion, not far from the same spot, while we were throwing coconuts ashore to the natives on the beach, one of my boat's crew was severely wounded with an arrow. On another occasion at Hut Bay, on the east coast, they nearly cut off a boat's crew which had landed with Mr. Portman. Many arrows were fired by the savages, and on our side only two shots were fired from a fowling-piece, for the purpose of frightening them.

"In 1882 and again in 1883 the island was visited by the station steamer, and the islanders accepted the presents which were left for them on the beach.

"In April 1884 I visited several places in the island, and rowed up two of the creeks without coming to hostilities with the natives. Presents were left in

many places. The natives had no hesitation in taking them, on our boat withdrawing fifty yards or so, but their bows and arrows were always handy. At one time I proceeded on shore in one of the ship's cutters, followed by the jolly-boat. After depositing yams, coconuts, and red cloth in a canoe which we found near the entrance, we rowed about three miles up the creek, and, then landing, visited a large hut about a quarter of a mile from the boats. We encountered no natives there, but on rowing down the creek, we found the sandspits on either side of the mouth covered with painted savages, armed with bows and arrows. The tide was out and a passage of only thirty or forty yards was left for the boats to pass through. It would have been easy to clear the spits with a few rifle shots, but wishing to avoid bloodshed, I resolved to wait in the broad part of the creek, where we had stopped rowing, until the tide rose. Apparently mistaking our actions for surrender, four natives put off in one canoe, and two in another, and, coming alongside our boats, they disdainfully refused the presents we offered, and by very peremptory gestures and shouts ordered us ashore. The canoe with the four men was made fast to the jolly-boat, and they commenced cutting away the lanyards and fenders, and by gestures ordered the rifles and the compass-box to be given up. On being shoved off, one of the savages took up his bow, and, in the twinkling of an eye, sent an arrow through the helmet of Mr. Jackson, apothecary, inflicting a slight scalp-wound. On this our men began to fire, and all the savages fell into the water. I stopped the firing as quickly as possible. One of the savages, taking the cane painter of his canoe in his mouth, tried to swim ashore with it. Two of the Port Blair Andamanese, by my order, jumped into the water and captured him, a fine young man, and unwounded. I was glad to see the remaining five savages emerge from the water into the mangrove jungle, all apparently unwounded except one, who had been hit in the calf by an arrow. The tide rose, the spits became covered with water, the natives retired, and we rowed out to the ship without further molestation, having broken up the two canoes which had attacked us, as a mark of our displeasure. The captive, to our great regret, died at Port Blair of pneumonia in the following month."

Shortly after this and other little episodes a great piece of luck befell us. In touching at one of the Cinque Islands, we found that a party of Járáwas, —the name which we at that time applied to all untamed natives—were on the island. We landed before daybreak in the hope of surprising their encampment, but they had heard our approach, and had made off into the bush. We only succeeded in capturing one old man, whom we carried down to the beach, biting and scratching and spitting at us like a wild cat. We took him on board, and showed him the wonders of our vessel, but he was callous to them. He was so exhausted and weak after his exertions, that we feared he would die on our hands. We therefore landed him at once; and, as I was obliged to return to Port Blair without delay, we steamed away, carrying with us the three dug-outs in which they had come over. A day or two afterwards I sent down a party of our tame Andamanese and a few convicts, under the command of Mr. Portman. The Járáwas resisted capture, and arrows were freely exchanged between the two parties, with the result that one convict was killed, and, as was found afterwards, some of the Járáwas were wounded. The latter were at last driven on to a rock at the end of the island, and after they had expended their stock of arrows, our men captured them all,

some twenty or twenty-five men, women, and children. Out of these Mr. Portman selected three women and about half a dozen men, and brought them to Port Blair. There they were treated with the utmost possible kindness, and some of them soon became friendly. After a month or two it was resolved to take the women and their husbands back to their homes. When we approached the island where they had been captured, they objected to being landed there, and, to our delight, pointed in the direction of Little Andaman as their home. We put them ashore there, with as many iron hoops, coconuts, bananas, and other things which they fancied, as they could carry. A few months later the remainder of our captives, excepting one who had died, were landed near their homes. They had promised by signs—we had got to understand each other well by this time, and they had picked up a few words of Hindustani —to return and bring their fellow-islanders with them. They did not return, and after waiting for a couple of days we steamed away much disheartened. However, the policy which we had pursued with great patience for a number of years was destined at last to be rewarded with success.

In October 1886 Mr. Portman was sent down in a sea-going steam launch, with a strong party of our Andamanese and three months' provisions. He anchored in a creek on the north-west of the island, and formed an encampment on one of its banks. The released captives, mindful of our kindness, soon came to see him, and in a few days men, women, and children came fearlessly into his camp, and some even ventured on board the launch. Taking with him some of his newly-made friends he coasted round the island, landing wherever there were habitations. Although timorous at first, the Ongés, as they called themselves, soon learnt that we meant them no harm, and had things to give them which they valued and for which we asked nothing in exchange. In this manner friendly relations have been established with the islanders, some of whom have even ventured to visit Port Blair. Tact and caution have still to be exercised, as was recently proved by an old savage, who was disappointed at not getting the present he expected, nearly killing the Chief Engineer of our steamer by a blow with an axe; and it will take a year or two more before shipwrecked crews can land on Little Andaman with the safety which would be assured to them in Great Andaman.

The natives of the several islands are so like that we can tell no difference between them, but their languages are totally dissimilar, as are also their habits. In place of clusters of small huts, the Little Andamanese build large beehive-shaped huts, about sixty feet in diameter, in each of which a community of some fifty people dwells. The women wear a tassel in front in place of the leaf worn in Great Andaman. Their bows and arrows are quite differently shaped, the bows being more like the European bow; their dug-out canoes are square in stem and stern; their mode of dancing is also quite different; but the greatest contrast is in their numerous children of both sexes. As far as we have been able to make out, they have no religion of any kind. I regret that time does not permit of my telling you more about their habits, or about various exciting little adventures which we have had with them.

Barren Island.—Near the beginning of my lecture I spoke of Barren Island, which is situated about seventy miles from Port Blair in a northerly direction. It does not deserve the name of Barren, as its outer slopes, the highest points of which reach a height of 1100 feet, are covered with dense vegetation from the sea-level to the summit. You will see from the transparency which I shall presently show you that the island is like a huge basin, on the rim of which on the western side there is a deep, wide breach down to the water's edge, giving entrance to a large barren amphitheatre, circular in shape, in the centre of which rises, to a height of 1015 feet, a cone, like a huge black sugar-loaf, with almost symmetrical outline. The sides have a slope of 32°, but they look steeper, and certainly feel so when one ascends them, the surface, void of vegetation, being covered with a dark-coloured ash, in which one's feet sink above the ankles. To reach the foot of the cone one has to cross half a mile of rugged black scoraceous crust, the fissures and hummocky surface of which cannot be traversed without difficulty and damage to one's boots. The cone is said to be almost identical in size with the present cone of Vesuvius. At the top there is a crater 78 feet in depth, the floor of which is 60 feet in diameter, and is covered with fine pinkish sand. A large party of Andamanese accompanied me down, and it was a weird sight to watch them dancing in it like imps of darkness, their feet causing hollow-sounding reverberations, which made one feel as if the crust was very thin, and I confess to having experienced a feeling of relief when I got out of it. The last eruption on record took place in 1789, but up to this date a small column of steam is always seen rising into the air from the summit, and eggs could be roasted under many of the stones near the top. At the landing-place there is a hot spring, the temperature of which is found to be less and less at every succeeding observation. In 1863 it was recorded as being 163°, and in 1884 it was found to be only 116°. The inference from this is that the interior of the volcano is gradually cooling.

Penal Settlement.—Before I conclude my lecture, you would perhaps like to hear something about the penal settlement at Port Blair. Port Blair is situated on the east coast of South Andaman, in latitude 11° 42′ north, and longitude 93° east. Ross Island, about a mile long and quarter of a mile broad, on which are placed the British and Native Infantry barracks, Government House, the commissariat storehouses, and the principal offices, is situated at the mouth of the harbour, to which there are two entrances, the one on the north side being about two miles broad and the other on the south side about half a mile broad. The harbour runs in for about six miles. Chatham Island, on which are located the saw-mills and a large hospital, occupies a central position in it, and Viper Island, where is situated the only jail in the settlement, occupied by convicts who have committed local crimes, is near its upper end. The hills and valleys on either side of the harbour have been cleared of forest, and are now reserved for grazing and cultivation.

The first settlement at Port Blair was established in 1789, under Lieutenant Blair of the Indian Navy, who had completed a survey of

the islands, which has been found wonderfully correct in the survey which has recently been made under Major Hobday. In 1792 the settlement was transferred to Port Cornwallis, in North Andaman; but this station, proving very unhealthy, was abandoned in 1796, and from that date the islands were unoccupied by aliens until after the Indian Mutiny in 1857, when it became necessary to find a place to which to transport the mutinous Sepoys. A committee, under the presidency of Dr. Mouatt, having reported favourably of Port Blair, a penal settlement was re-established there, and the first batch of convicts arrived in the beginning of 1858. The settlement was very unhealthy at first, the death-rate in 1859 having been no less than 63 per cent., and, although things mended after this, the mortality during the first ten years averaged 18·56 per cent. per annum. Various measures were then taken to reduce the mortality, and in 1870-71 it fell to 1·2 per cent. So much attention had been paid to health that the development of the colony had been retarded and reins of discipline slackened. It was decided that a more strict enforcement of punitive discipline and labour should be carried out, and the result was that although due regard was paid to the feeding, housing, and clothing of the convicts, the death-rate rose to 5 or 6 per cent. Of late years, however, the rate has been under 2 per cent., which is less than that of many cities in this country, and still more so than the mortality among the free and jail populations of India.

The penal settlement at Port Blair is probably the largest in the world, the number of convicts detained there generally numbering about 12,000. About three-fourths of them are under sentence of transportation for life, and the remainder for terms of seven years and upwards. About 65 per cent. are Hindus, 25 per cent. Mohammedans, and the rest chiefly Buddhists from Burma. They come from all parts of India and Burma, the refuse of 250 millions of people, and in the diversities of castes and nationalities and languages among them lies a great safeguard, as it prevents any likelihood of combination. Originally a large proportion of the convicts were mutineers, and, accustomed as they had been to military discipline, a better nucleus for a penal settlement could not have been found. Our system of administration is, I believe, different from any other in the world. It is one great system of reward and punishment. The most experienced officials in India are filled with amazement when they come down and see how we manage. To guard this large number of convicts, there is only one company of British infantry, a wing of Madras native infantry, and a police force of 650 men enlisted chiefly in the Punjab. The garrison is, as already mentioned, quartered on Ross Island, and the police are located in a few strong posts, especially at the jetties; their head-quarters and reserve being at Aberdeen, on the so-called mainland opposite Ross. The garrison is kept *in terrorem* over the convicts, and, although there has never yet been occasion to call for the active services of the troops, their presence is necessary. The police have nothing to do with guarding the convicts, and only step in when offences are committed, as they would do among a free population. One of their most important duties is to keep careful guard over the boats; and how well this duty is performed may be judged from the fact that

there has not been a boat-escape since 1880, although a fleet of over 130 boats and canoes has to be kept up for the work of the settlement.

The convicts are immediately managed by their own petty officers, who are also convicts. They are quartered in fine, well-ventilated wooden barracks, raised on piles about eight feet off the ground, and these barracks are scattered in groups all over the settlement, some of them miles away from any police station. There are no enclosures of any kind round the barracks, and the convicts are shut up in them at night by flimsy trellis-work doors fastened by common padlocks. It would cost a ruinous sum to place guards over each group of barracks, or over files at work, and it is recognised that if they were inclined to break out, they have no object in doing so at night, as they have better opportunities of doing so by day, when employed in felling forest in gangs of sometimes a couple of hundred men with axes in their hands. As long as the boats are well secured, they have nowhere to escape to except the forest, where they can find no means of subsistence, and are likely to die of starvation or be shot by the Andamanese. So well is this known, that bodies numbering sometimes five hundred are sent out under only their own petty officers to places ten miles distant from any guard.

For the first four years of their servitude the convicts are subjected to very strict discipline and hard work. If their conduct during this period of probation is good, certain indulgences are granted to them. In place of being fed in mess-gangs, dry rations are served to them—a privilege, the deprivation of which is a great trial to the natives of India, who fondly love to knead and bake the chupatties or scones, their staple diet. They then also receive an allowance of twelve annas a month—equal to eighteenpence if the rupee were worth two shillings—with which to buy little luxuries such as sugar, tobacco, milk. After every succeeding three years of good conduct an additional allowance of sixpence a month is granted to them until the large sum of two rupees is reached. The smartest and best conducted are selected as petty officers, who commence on a gratuity of two rupees a month, and a few of them rise to be jemadars on eight rupees, on which they are counted passing rich. They are liable to be reduced from one grade or class to another if they misbehave; and they have many ups and downs, but every inducement to good behaviour is held out to them. Male convicts are allowed, after ten years' good conduct, tickets to support themselves. There are now some three thousand three hundred self-supporters in the settlement, about half that number earning their livelihood by cultivation, and the rest by keeping cattle or working at various trades, such as blacksmiths, carpenters, petty shopkeepers, etc. A certain amount of liberty is allowed, but they are under clearly prescribed rules, such as having to answer roll-call every morning and evening, and not leaving the Division in which their villages are situated, and they know that for any breach of rule their tickets may be cancelled and they may be remanded to hard labour. Male self-supporters are permitted to marry well-behaved female convicts who have been not less than five years in the settlement, and many happy homes are formed.

Life-convicts are pardoned, and permitted to return to India, after

twenty years' servitude, if their conduct has been uniformly good and their return is not considered to be attended with danger to the community. Dacoits or professional gang-robbers have, however, to serve twenty-five years on account of their well-known proclivity to return to their old pursuits. Term-convicts cannot get tickets as self-supporters, but the Chief Commissioner is empowered to grant remissions not exceeding one-sixth of the sentence to such as have held responsible positions, provided, of course, their conduct has been uniformly good.

Pardons are occasionally granted for deeds of gallantry, and nothing can exceed the daring which the convicts show whenever opportunity offers, such as in seizing murderers red-handed with axes or other weapons in their hands, the hope of pardon being, of course, the great inducement. I could tell stories of many such gallant deeds if time permitted.

I may here mention that only two murderous assaults by convicts on Europeans are on record. It is on the petty officers that such attacks are made. They are "between the de'il and the deep sea." The officers insist on their exacting full tasks from the convicts. This duty is not always judiciously exercised by the petty officers, and the convicts vent their rage on them. It also occasionally happens that a morose man, tired of his perpetual grind, knocks a petty officer on the head with the sole object of getting hanged, and thus escaping from trouble in this world without any regard to the hereafter.

The settlement is divided for administrative purposes into two Districts, under the charge of the Deputy Superintendent and the First Assistant Superintendent respectively; and these districts are divided into five Divisions, each under a gazetted officer. In each Division there is also a European overseer, after whom come the petty officers, who, as already stated, have direct control over their brother convicts. Some—perhaps the majority—of these petty officers are capital fellows. You should understand that the convicts do not as a rule belong to criminal classes, such as are found in this country. The murderers, of whom, as already mentioned, there are about seven thousand, are as a rule the best men in the settlement, although, of course, there are some great villains among them, and all are men of strong passions, over whom a firm hand has to be kept. It must be remembered that in the case of every murderer there has been some extenuating circumstance or want of absolute certainty, otherwise he would have suffered on the gallows. In the majority of cases their crimes originated from causes such as jealousy, and disputes about fields and boundaries. In this country the question, "Who is she?" is asked, but in India the question is, "Which Z?" as it is understood that "zar, zan, zamin"—money, woman, land—are at the root of all crime. Each officer is allowed a boat's crew of convicts, who do most of the household work, and they make willing, obedient servants, as this is the most comfortable billet they can get, and they know that they will be remanded to hard labour if they do not give satisfaction. The ladies especially get fond of them, and frequently believe that their convict servants must have been unjustly convicted, so docile and obedient are they.

I have not time to enter into details regarding the products of the

settlement. We have large tea-gardens, which, although they have not yet reached maturity, are expected to yield a net profit of about 20,000 rupees during the current year. Liberian coffee, cocoa, arrow-root, India-rubber, and other things, are being successfully cultivated; and when I tell you that each convict receives eight ounces of vegetables daily, you may imagine what extensive gardens we have to keep up. Between one and two hundred thousand coconut trees have been planted, and as each tree when it reaches maturity may be expected to yield a profit of one rupee, a large revenue will in time be derived from this source. The chief products grown by self-supporters are rice, Indian corn, and sugar-cane.

I have not time also to tell you of the manner in which the convicts are worked. The most important work on which they are employed is clearing forest land and reclaiming mangrove swamps in the fair weather, and road-making and repairing during the rains. There are now some eighty miles of roads in the settlement.

The gross cost of the settlement is about thirteen lakhs of rupees. The receipts amount to about four lakhs, so the net cost to Government is about nine lakhs—that is £90,000, if the rupee were at par. The above figures are exclusive of local productions, for which no cash expenditure is incurred, and which are used up in the settlement. These are valued at about four lakhs a year.

I must apologise for the meagreness of this sketch of the penal settlement. It is a subject which would afford ample material for a lecture by itself.

PRELIMINARY NOTE ON THE GEOLOGICAL STRUCTURE OF THE SINDANG-BARANG DISTRICT, ON THE SOUTH COAST OF JAVA.

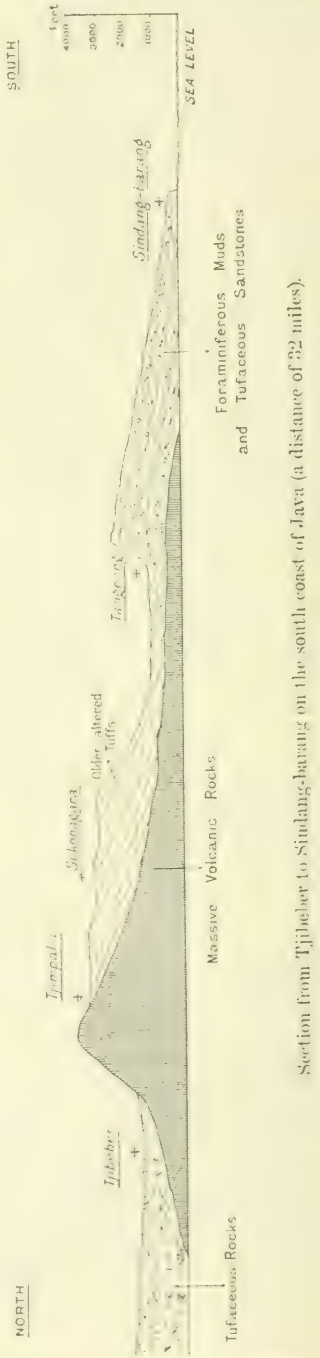
By H. B. Guppy, M.B.

[*The following note is extracted from a letter addressed to Dr. John Murray, of the* Challenger *Expedition, and received by him from Dr. Guppy on 4th January* 1889.]

I should commence by saying that this is only a preliminary note concerning the results of observations made during a traverse on foot from the railway station of Tjibeber to Sindang-barang, *a distance of* 32 *geographical miles* as the crow flies, but about 50 English miles by the road. I traversed this distance to the coast and back (about 100 miles) in six days, making extensive notes and collections. The most interesting portion of the district examined, the 12 or 13 miles between Tangoong and the Sindang-barang coast, was the part where I was most hampered in carrying out my purpose satisfactorily. This region is said to be much frequented by tigers, the result being that I found it difficult to get my men to leave the road for any distance, and in more than one locality I

had to go alone. Here we had to confine our walking to the heat of the day, and even then in some places I had to load my rifle before my men cared to follow. It is perhaps to the tiger-scare that I am indebted for this opportunity of striking upon ground new to the geologist. In a couple of days I am going to examine the coast further to the east of Sindang-barang.

The accompanying diagram, drawn from the base of the great volcanic cone of Pangerango to the sea-coast at Sindang-barang, will serve to illustrate my remarks. The railway at Tjibeber lies in a broad plain, extending northward to the base of Pangerango, and elevated 1400 to 1500 feet above the sea. Rising abruptly on the south side of this plain is a broad, mountainous plateau, about 10 miles across, reaching a height of nearly 4000 feet on its north side, but sloping away to its southern edge, where it is about 3000 feet above the sea. It is on this elevated plateau that the towns of Tjimpaka and Sukonagara are situated. South of it, there is a broad, deep valley, 10 miles in width, on the southern side of which lies the town of Tangoong, about 1000 feet above the sea-level. On the south side, overlooking Tangoong, rises an abrupt line of steep-sided hills, often displaying vertical faces, and stretching away like a line of escarpment to the eastward and westward as far as the eye can follow it. This is the northern edge of a second elevated plateau, which, being raised from 2000 to 2500 feet above the sea, where it overlooks Tangoong, slopes gradually through a distance of about 12 miles to the coast, where it terminates in cliffs 40 to 50 feet high. Such is the surface configuration of the district lying between the base of Mount Pangerango and Sindang-barang. As will be explained below, I should point out here that we should regard the valley of Tangoong, through which a large river runs, as a



Section from Tjibeber to Sindang-barang on the south coast of Java (a distance of 32 miles).

valley of denudation, now separating into two parts what was once *a continuous plateau-land extending from the heights south of Tjibeber to the sea-coast.* Having viewed the neighbouring districts in profile from Palabuan on the shores of Wynkoops Bay to the westward, and from the railway line near Sukaboomi to the north-west, and from several other localities, I am satisfied that this is the general character of the sea-border of Java from Wynkoop Bay to the eastward of Sindang-barang, my acquaintance with the surface-configuration covering quite 60 miles of the sea-border and 30 miles inland. When I speak of this part of the sea-border of Java, as *having the character of a table-land sloping gradually to the sea from an elevation of* 3000 *to* 4000 *feet* 30 *miles inland,* I do not imply that this level district has not been carved out by the agencies of denudation into peaks and valleys. The reverse is the case: and it is only by obtaining distant views in profile of this region that the observer is able to form a comprehensive idea of the configuration of this part of the sea-border of Java. When this is understood, the geological structure is readily explained.

On referring to the section, it will be observed that the level district around Tjibeber is largely formed of tufaceous rocks. The northern part of the elevated plateau south of Tjibeber is composed mostly of massive volcanic rocks (basic, andesite, etc.), which are exposed in the road-cuttings, and are often decomposed to a considerable depth. On the summit of the plateau, near the towns of Tjimpaka and Sukonagara, there occur tufaceous rocks often bedded and inclined at angles of 20° to 30°: they are often soapy to the feel, apparently serpentinised (specs. 67 to 71).[1] Tufaceous rocks, often partly serpentinised, bedded and similarly inclined, are exposed on the steep south slope of this plateau, together with decomposed volcanic rocks (specs. 64 to 66). Descending into the Tangoong valley at the base of this slope, we find tufaceous sandstones and clays often horizontally bedded, apparently non-foraminiferous and sometimes rather soapy to the touch (spec. 62). On the south side of the Tangoong valley commence the foraminiferous, fossiliferous muds and tufaceous sandstones, horizontally bedded or nearly so, and composing the gradually sloping plateau that stretches away for 12 or 13 miles to the coast (specs. 1 to 60). The horizontal bedding is well displayed in the vertical faces of the steeply escarped line of hills overlooking Tangoong. This is the northern border of the plateau, which here reaches a height of 2000 to 2500 feet. The rivers have cut steep-sided valleys with very small gradients into this table-land, and the horizontal bedding is frequently displayed in vertical faces high up the sides of the valleys. Reaching the coast we find that the plateau terminates in cliffs 40 to 50 feet high, and formed of the prevailing foraminiferous muds and tufaceous sandstones. No coral reefs occur at the coast, nor have any been upheaved in ages past.

It will be noticed in the section that I have given prominence to the underlying volcanic rocks. Only occasionally, as in the bed of a river, did I come upon them *in situ* in the plateau south of Tangoong. They are, however, very common as loose blocks in all the water-courses; and at heights greater than 1000 feet, and more than 7 or 8 miles inland,

[1] The specimens referred to by Dr. Guppy have not yet arrived. ED.

they occur on the surface often as boulders of andesitic and basic rocks, which get more frequent the greater the distance from the coast.

The thickness of these tufaceous sandstones and foraminiferous muds is probably not less than 1000 feet. Occurring as alternating beds they are sometimes exposed to the extent of several hundred feet in a single section on the face of a hill. I obtained specimens of foraminiferous rocks from all elevations up to 2000 feet. To sum up briefly, I may say that the structure of the sea-border of this part of Java is as follows :— *A basis of massive volcanic rocks overlain by submarine tuffs and volcanic muds as far as* 12 *miles from the coast, and by older and altered tuffs further inland. The upheaval in post-tertiary times has been very great, and can only be measured by several thousands of feet.* The examination of my collections will bring to light the depths at which these upheaved deposits were originally formed.

An examination of the district of Palabuan, on the shores of Wynkoops Bay, shows that similar formations there prevail, but on a much less extensive scale. Starting from Sukaboomi, about 22 miles from Palabuan as the crow flies, and 1800 to 1900 feet above the sea, I descended for the first 8 or 9 miles along the continuation of the volcanic slope of Mount Pangerango. During the next 8 or 9 miles the country is much cut up by the rivers into deep valleys; and here the soft foraminiferous and fossiliferous deposits are exposed in the river-beds, and are overlain at the surface by tuff rocks, compact and friable, and sometimes containing sea-shells (specs. 76 to 77); in one river 5 miles from the sea I found large detached blocks of a hard white limestone, containing simple corals, molluscan shells, and foraminifera (specs. 83 to 86). Beyond lies the great valley leading down to Palabuan, and on the coasts around Wynkoops Bay are exposed old river-gravels and muds (specs. 95 to 96), and the old volcanic rocks of the district. In the region around Palabuan I did not find the soft foraminiferous deposits more than 8 or 9 miles inland, and at greater elevations than 300 feet above the sea. They are overlain by submarine tuffs up to 500 and 600 feet, and in their turn conceal the basic and andesitic rocks of the district. In all probability, however, if I had further explored the river-courses, I should have found these recent deposits at greater elevations. As at Sindan-barang, there would seem to be no coral reefs around Wynkoops Bay.

In conclusion, I would point out that I have only here given some of the general results of my observations on the south coast of Java. There are a great many interesting details I cannot refer to in a preliminary note.

THE TRANSVAAL, OR SOUTH AFRICAN REPUBLIC.

By S. P. Ford, Advocate (*Transvaal*).

(*Read at Meeting of British Association, Bath*, 1888.)

Situation and Extent.—The Transvaal lies between 22° and 28° south latitude, and 25° and 32° east longitude. It is surrounded on the north by native territory now under British protection, on the east by Portuguese possessions, Swaziland, and Zululand, on the south by Natal, the Orange Free State, and the Cape colony, and on the west by Bechuanaland. You will see, therefore, how the Transvaal is hemmed in, and that it has no seaport of its own, which is one of the greatest grievances afflicting our President, Paul Kruger. The territory comprises about 119,000 English square miles. It is about half the size of the Cape Colony, six times the size of Natal, and, as compared with the areas of European countries, we may say that it is as large as Great Britain and Ireland taken together.

History.—The Transvaal was taken possession of in 1839 by a number of Colonial (Dutch-speaking) Boers, who were dissatisfied with the British Government on account of the abolition of slavery. In 1852 the British Government acknowledged the independence of the State, which was thereafter known as "The South African Republic." After this all went well with the State until, in about 1876, a war between it and Secoweni, a rebel chief residing within the limits of the territory, so drained the finances and other resources of the people that general ruin and disorder were fast approaching. It was then, upon the representations of a great number of people residing in the State, that H.M. Government, for the safety and protection, not only of the white people of the Transvaal, but also of the whole of South Africa, sent Sir Theophilus Shepstone from Natal with a body of police, with instructions to annex the Transvaal if he found it ripe for such a measure. On Sir Theophilus Shepstone's arrival, being met almost everywhere with welcome, and very little opposition, he proceeded to Pretoria, the seat of Government, soon arranged matters with the then President (Mr. Burgers), hoisted the British flag, and in a long proclamation gave the reasons for so doing, and promised in Her Majesty's name in other matters to respect the constitution and laws of the land. Everything went smoothly for a time, the debts of the State were liquidated, and a High Court was established. At the head of the latter was placed the present Chief-Justice of the Transvaal, J. G. Hotze, a very able lawyer, and I had the honour of being sworn in as Her Majesty's Attorney-General, both appointments, of course, being subject to the subsequent approval from headquarters. And my own impression is that had the British Governor allowed Sir Theophilus Shepstone to fulfil the promise (contained in his proclamation) of calling together the legislature of the country, and not deprived them, as it did, of all voice in the government, we should never have had the war of 1880-81, nor have suffered the humiliation of retreating from the country,

and seeing it once more an independent state. To the British it was a sad blow, but it was more cruel to those of the Boers who remained loyal to Her Majesty, because they will never hear the last of it from their fellows. Now, however, that a few years have rolled by, many (I for one) see that unexpected good has come out of the retrocession, because no sooner had the Boers the country again in their own hands than they did what to people here would seem altogether opposed to progress and free trade, namely, they granted to landed proprietors who would pay for them concessions to work the mines, or supposed mines, on their land. This had a wonderful run, hundreds of concessions were taken out, and the whole country became quickly alive with prospectors; and gold, silver, iron, coal, and what not, were soon discovered to exist where previously it was not dreamt of. These concessions do not all now exist, as a great many of them fell through for want of payment, or non-compliance with the conditions upon which they were granted, and the Boer Government, moreover, discontinued their issue, substituting the present "Gold Law," which is a marvel of legislation, well suited to the circumstances of the country, the owners of the soil, and, at the same time, to capitalists. Within the last eighteen months some 25,000 or 30,000 people have rushed from the adjoining colonies and states, and the country is at present one of the most prosperous in the world—that is, for its size and age. It is very easy for those who, like myself, know the resources of the country, to predict a grand future for South Africa.

Government.—The legislative power of the Transvaal is vested in a representative institution called the "Volksraad" (or "Council of the People"). There are thirteen districts in the country, some of which return three and others two members. The executive is vested solely in the President, but he has a body called the "Executive Council" to refer to for advice, and generally he does nothing of importance without first consulting them. This executive is composed of the Commandant-General, the Secretary for Native Affairs, two non-official members, the State Secretary, and the Minister of Mines. The President and his executive have seats, but no votes, in the Volksraad.

Courts.—After the retrocession the High or Supreme Court was continued, but the number of judges has been increased from two to three, and within the last month the Volksraad have authorised the appointment of two more. The fourth is already nominated, and the fifth will soon, I trust, be obtained. Having had the pleasure and honour of practising before this Court, I can assure the people of this country that they need have no fear about intrusting their persons and property within the jurisdiction of our judges. Three of these judges are English barristers, who were for many years advocates at the bar of the Cape Colony. The fourth judge is a Hollander who is universally respected. We have eighteen barristers (or, as they are there called, advocates), and some fifty solicitors (or attorneys, as we call them). Besides the High Court, there is in each of the thirteen districts and at each gold field a magistrate (or landdrost) with limited civil and criminal jurisdiction, and a land court.

LAWS.—The laws in force are nominally the Roman-Dutch, and a few local ones, but practically you may take it that the English laws are the most followed, because most law-suits now-a-days arise out of *modern* commerce and mining, and the old Roman-Dutch laws have little to say on the numerous points which arise on those two subjects, and we lawyers have to go to the English authorities. We have a very fair law-library in the Court-house, composed principally of English text-books and reports. Of course we generally, when on the law points of a case, quote first of all, all the Roman-Dutch law on the subject; but my experience is that in most cases, not arising out of wills, we have to search for English authorities, and that upon *them* the cases are mostly decided.

LANGUAGE.—By law the language of the country is Dutch, but, by an Act passed this year, officials have the right of repeating in English whatever they have first said in Dutch. This law was passed to meet the wishes of the large immigrant English-speaking people, and I am very sorry to observe that at Johannesburg badly-disposed correspondents of English newspapers have attempted to arouse ill-feeling here by misrepresenting the nature and object of this law. To my mind, it speaks very well indeed for the Boers that they could so far restrain their dread of the British as actually to pass a law allowing Boer officials to utter and use the at one time so much hated English language. If the mass of the British portion of the population of the Transvaal continues to observe the same friendly attitude as they have done, the Boers will, ere long, see the justice and necessity of allowing us to take part in the legislation of the country. At present, of course, there is yet a *lurking* dread of the British again getting into power and ruling.

RAILWAYS.—This suggests to my mind to remark on the slow progress of the railways. Here, also, the chief cause of there being none yet in the Transvaal, is the same lurking dread of British influence. The President always says, "First let me have a line to Delagoa Bay, and then you may build as many more railways as you wish." His object is to *secure and establish* a trade with and through a port not British, in the hope that, once done, the trade with the Cape Colony and Natal will be of no consequence. However, I doubt whether the President is so strongly bent on this as he was a year ago, because he has experienced such difficulty and defeat in his endeavours to come to terms with the holders of the short line through the Portuguese territory, namely, Messrs. Colonel M'Murdo and Co., of London, that he, the President, of his own accord, asked leave of the Volksraad this year to negotiate with the Government of Natal for the continuation through the Transvaal of their line. The Natal Government very wisely have neither been asleep nor waiting for a treaty with the Transvaal, but have been industriously pushing on their line towards the borders of the latter. It is already open for 189 miles.

The Cape Government are also busy in planning a continuation of its line, which goes as far as Kimberley, a distance of 647 miles, and it is generally believed that the Cape Government, in conjunction with H.M.

Imperial Government in Bechuanaland, will devise some scheme, either by way of concession to a company or otherwise, for extending the line from Kimberley to the Malmain Gold Fields, which are partly in the Transvaal and partly in Bechuanaland. Fortunately for the Transvaal, it is nearly all flat country through which the lines from Natal, the Cape Colony, and Delagoa Bay, will run, so that as soon as they are once started, no long time need elapse before they are completed.

Population.—Before the rush to the gold-fields at West Wekand last year, the white population was computed at 60,000; now it is nearly 90,000. The natives are reckoned as numbering 600,000, but most of these latter are located far to the north, and are little or no trouble to the residents in those portions of the country chiefly occupied by the white man. We feel as safe in any of the Transvaal towns as the people of Great Britain do in theirs. Nor do we ever dread an invasion from the north, or from the Zulus and Swazies in the east, the very nature of the natives not being to go far away from their own fastnesses and country. They have, moreover, a wholesome dread of the Boers, who are far better able to cope with them than European regular troops, each man fighting on his own account, and the warfare being more guerilla than anything else.

Climate and Health.—The climate is sub-tropical, but not at all too hot for Europeans. It is dry, and the early mornings, the evenings and nights are, in summer, delightfully cool, making up for the oppression of the weather in the middle of the day. Spring and autumn are simply delightful, and the winter is of short duration. The rains do not fall in winter, but in summer, which greatly modifies the heat. I have often heard English people, fresh from here, remark that they have felt the heat of the English summer more severely than the heat of the Transvaal. Having lived there eleven years, I can confidently recommend any one to try our climate, especially those who suffer from pulmonary complaints, for which, on account of its dryness, it is specially suited.

Education.—The Boer Volksraad have paid a great deal of attention to elementary education, and aid by liberal permanent grants schools in every town and district. Higher education is also receiving attention, and, as sufficient numbers of students present themselves, no doubt such attention will be increased. At present most of us send our elder children to the Cape colleges and seminaries, or bring them to England.

The Press.—For such a young country, I think our press compares very favourably with that of other countries. We have thirteen newspapers, many of which cover six large sheets.

Agriculture, &c.—The Transvaal affords varied and abundant scope for the agriculturist, and the horse, cattle and sheep farmer. The climate of the southern districts is more peculiarly suitable for the breeding of horses, cattle and sheep, the growth of cereals, vegetables, tobacco,

etc. The northern districts are, on the other hand, better suited for wheat, which is produced equal to any in the world; cotton, coffee, and sugar-cane. The country is *well* watered, but it has few *large* rivers, and the latter are (and will be until locks are constructed as on the Thames) unnavigable for any great distances.

THE PHILIPPINE ISLANDS.

Compiled from Various Sources.

By W. A. Taylor.

In 1519, the Portuguese navigator, Magellan, set sail from San Lucar de Barrameda and, having passed through the strait which bears his name and discovered the Marianne or Ladrone Islands, reached Cape St. Augustin, on the south-east coast of Mindanao, in March 1521. After having passed seven days on the island, he proceeded to Zebu, and was killed by the natives on the adjacent island of Matan. Three years later, Ruiz Lopez de Villalobos named these islands after Philip II. of Spain, and in 1571 Miguel Lopez de Legaspi, placed in command of an expedition by the king, visited Zebu, Panay, and others of the Bisaya Islands and, passing on to Luzon, established a colony at Manila. Since then, the Spaniards have had to contend against Chinese and Japanese pirates and the native inhabitants. In 1762, the English took Manila, when the garrison retreated into the neighbouring country, and maintained a guerilla warfare until the establishment of peace between the two countries in 1764. During the long period the Philippines have been in the possession of the Spaniards, the islands have made little progress. Administrative incapacity and indifference, so detrimental to the other colonies of the Spanish crown, have retarded the natural development of these rich and fertile islands also.

The Philippine Archipelago extends from 4° 34′ to 21° 13′ N. lat. and from 116° 59′ to 126° 56′ E. long. It is composed of 1000 to 1200 islands, half of which are of insignificant dimensions and many uninhabited. The most southern island, Mindanao, is linked to Borneo by the Sulu Archipelago; and the long island of Palawan, to the west, is separated from the same island by the Balabac Strait, in which lies the island of the same name. The estimates of area and population are so numerous, and differ so widely, that the following figures cannot claim to be more than rough approximations:—Philippine Archipelago: area, 115,000 square miles, and population 6 millions. Luzon: 44,000 square miles, and population 3½ millions. Mindanao: 35,000 square miles, and population 600,000. Mindoro: 3900 square miles, and population 60,000 (including Manduque). Palawan: 5500 square miles. Panay: 4500 square miles.

The islands are mountainous and have numerous volcanoes. The Caraballos in Luzon run the whole length of the island, and contain peaks over 9000 feet in height. To the west lie the Zam-

bales Mountains. The volcano Albay at the south-western extremity of the island, is subject to frequent eruptions, and the Taal, which is situated on an island in Lake Bombon, south of Manila, and is only 870 feet high, is in constant activity. In July 1888, a destructive eruption of Manyon, in Luzon, occurred.[1] The country is plentifully watered; the principal rivers of Luzon are the Capayon in the north, and the Pasig, which drains the large Lake Bay, and flows through the town into the Bay of Manila. The topography of the interior of Mindanao is but little known, and such information as has been published cannot be relied on. An account of the orography of the island, as accurate as can be given, will be found in the *Scottish Geographical Magazine*, vol. iii. p. 534. In 1887, a Jesuit father discovered the source of the Rio Grande.[2] The cordillera of Quimanquil confines on the west the Tagoloan valley in the district of Misamis. The Jesuit heard that the Pulangui, or Rio Grande, has its source on the other flank of these mountains north-east of Sumilao, but he did not visit the place himself. Little is known of the interior of the other larger islands, but they appear to be mountainous. The soil is volcanic and very fruitful, minerals abound in the mountains, and the extensive forests yield a great variety of useful woods.

The native inhabitants fall mainly into three great divisions: Negritos, Malays, and Moros.

The Negritos, called Aëtas in Luzon and Atas in Mindanao, belong to the dwarf brachycephalous race, which probably in primeval times inhabited a great part of the Malay Archipelago.[3] It was for a long time supposed that this tribe was confined to the islands of Luzon and Mindanao, but recent explorations have rendered it impossible to affirm with safety that they do not exist on any of the larger islands, except Manduque.[4] Little is known of their habits and disposition, for in Luzon they have been driven into the furthest recesses of the mountains by Malayan invaders, while in Mindanao they have been able, from some unexplained cause, to offer greater resistance to the invaders, and have intermixed with them, so that the type is no longer pure. Hence they have been called Malays by some writers. As far as is known, their habits are almost identical with those of Andamanese, a tribe of the same race. Like them, the dwarfs of the Philippines live by the chase, and dwell in small portable tents of matting. Their implements are of wood, bone, and shell, but never of metal, except such as have been acquired in recent times from other tribes. They are of a mild disposition, and display great domestic affection. They are monogamous, and faithful to the marriage vow. The wedding ceremony is singular: two saplings are chosen at a suitable distance from one another; each of the bridal pair having climbed up one of these, the elders of the tribe bend down the trees until the man and woman knock their heads together.

The first Malay invaders, the Ilocanes, Guinaanes, Apayaos, etc., in Luzon, and Mandayas, Bagobos, etc. in Mindanao, now dwell chiefly in the

[1] *Deutsche Rundschau*, Jahrgang xi., Heft 2.
[2] *Boletin de la Sociedad Geográfica de Madrid*, vol. xxv., Nos. 1 and 2, p. 39.
[3] *Vide S. G. M.*, vol. iv., p. 670.
[4] Prof. J. Blumentritt, *Globus*, vol. xlviii. p. 7.

inland districts, and are heathen. Those tribes, which still inhabited the coast at the time of the Spanish conquest, such as the Ilocanes, were very soon converted to Christianity, and have now acquired a certain degree of civilisation. Some of them show signs of an admixture of Chinese blood, particularly the Igorrotes, who have slanting eyes. A kind of turban like that worn by the fishermen of Fo-Kien is common to the Igorrotes, Tinguianes, Bagobos and other tribes. Articles of Chinese manufacture, found in various burial-places all over the archipelago, particularly a kind of porcelain known to be of great antiquity, prove that communication with that country must have existed long before the arrival of the Spaniards, and, therefore, it is not improbable that traces of the Chinese type may appear. These ethnological questions, however, are very intricate, for, among the Igorretes, for instance, some individuals have the slanting eyes of the Chinese, while others exhibit the dark skin and wavy hair of the Negrito. Again, the Tinguianes, supposed by some to be of mixed Chinese race, do not possess the characteristic features, and have probably acquired their peculiar customs from their neighbours, the Igorrotes.[1]

The villages are governed by chiefs, called Dattos in Mindanao, and Gobernadorcillos among the tribes of Luzon, more or less amenable to Spanish authority. Sometimes the office is hereditary, as among the Bagobos and Mindayas, and sometimes one of the wealthiest and most intelligent men is elected for life or for a term of years. Their power is limited by the council of elders, whose position is due solely to wealth and influence. In Mindanao slaves are kept, who are treated as members of the family, but, at the death of the master, one is slain to wait on him in the other world. Head-hunting is still practised, and prevents the increase of population. On this account the houses are built on an eminence and raised on piles; access to them is gained by means of a notched bamboo, which is drawn up at night. They are built of bamboo bound together with Bejuco (*Calamus rotang*) in Mindanao; in Luzon, pine and the nipa palm (*Nipa fruticans*) are also used. Openings are left to serve as windows, but the Igorrotes have also a style of house which is quite dark and which is entered through a trap-door in the floor. Rice and maize are the chief food of the Philippine islanders, but they also cultivate bananas, camote (a kind of sweet potato, *Convolvulus Batatas*), sugar-cane, tobacco, and coco. The Igorrotes lay out their rice fields in terraces on the sides of the hills, supported by walls of stone and clay and irrigated by a system of artificial channels. Pine-apples, coconuts, palm and bamboo shoots are also eaten, and the Bagobos are passionately fond of honey, or, rather, the imperfect larvæ of bees. Salt springs exist in Luzon, but in Mindanao this mineral is obtained by laying a tree trunk in the sea and leaving it there until it is thoroughly impregnated with salt, when the trunk is burned and the salt extracted by lixiviation and made into blocks. Horses, dogs, buffaloes, and fowls are the domestic animals of these islands. The Igorrotes keep pigs also, and cats are highly prized among them on account of the rats, but are hard to obtain. The Mindanao natives are fond of riding on their small

[1] *Mitt. der k. k. Geographischen Gesellschaft in Wien*, Bd. xxx., p. 9.

but sturdy horses; buffaloes they do not eat, like the natives of Luzon, but employ them only as beasts of burden. They are fond of the chase, and pursue deer and wild boars, both on horse and foot. Animals are also caught by traps, and decoy-birds are employed. The sugar-cane is grown for the manufacture of wine (*basi* in Luzon, *balaka* in Mindanao), which is drunk in large quantities at weddings, at the bringing home of a head, and at other festivals. The narcotics used are tobacco and betel-nut.

Iron is worked in both islands. The bellows consist of two lengths of bamboo, through which the air is driven into a nozzle of cane by means of wooden pistons worked alternately. Lance-heads, knives, betel boxes, etc., are made of iron, which is obtained by barter from the Moros, who in turn purchase it from the Chinese settlers. Shields of a long shape are made of wood, with a boss in the centre, and a ring on the inner side to pass the arm through. The round shields made by the Bagobos are used not only in war, but also as a protection against rain, the ring being placed round the head. A curious contrivance for the same purpose is found among the Igorrotes, made of bamboo bound together with Bejuco and covered with *Pandanus* leaves. It resembles the bow of a canoe, and the point comes over the head. Their other weapons are knives, bows and arrows, spears, and blowpipes. The lance-heads and butts, and the arrow-heads are of iron or bamboo, hardened in the fire, and sometimes barbed. Bejuco and Manila hemp (*Musa textilis*) are very extensively employed for baskets, mats, blowpipe darts, door hinges, hats, etc. All their shields, boxes, knife-sheaths, etc., are ornamented with linear designs and drawings of animals and birds.

The dress of the men consists of short trousers of Manila hemp, fastened round the body with a string, and a short jacket, which does not reach to the waist. The natives of Luzon wear, in their own villages, only a loin-cloth passed between the legs and knotted round the waist. On the head they wear, on state occasions, a helmet of Bejuco, adorned with feathers, and at other times the turban referred to above, which is made of coloured cotton or of the prepared bark of the Balete (*Ficus Indica*). The women wear a *saya*, a short petticoat reaching to the knees, or, among the Tinguianes, a *cuba* or apron, made of fibres of *Arenga saccharifera*, and also a jacket, similar to that of the men, but closed in front. A sort of sash of coloured cotton or bast also is wound round the waist. Numerous ornaments are worn by both sexes: necklaces of glass and agate beads, and metal ear-rings of nautilus shell, wood, etc., bangles, toe-rings, and diadems. The women, in particular, load themselves with as many of these trinkets as they can find room for. The hair is left long, and rolled up into a knot at the back of the head. Children go about quite naked.

Both men and women are tattooed, the former down to the knees. In Luzon, a kind of punch of buffalo horn, in which five or six wire points are inserted, is the instrument employed; in Mindanao the operation is performed by the Atas with a small semicircular knife. The colouring matter is the soot of bamboo, pine-wood, or the ashes of blue woollen stuffs. Circumcision is practised, but, in Mindanao, probably in

the families of Dattos only. The Bagobos file their teeth, while the married Igorrote women dye them with soot from the sugar-cane. The fashion formerly prevailed, among all the tribes, of deforming the back of the head artificially by compression, and is still in vogue among the Tinguianes.

The musical instruments are a kind of gong procured from the Chinese, a drum of bamboo or hollowed wood covered with skin, and a flute. The Tinguianes have also a Pan's-pipe, and the Bagobos a guitar, the strings of which are made from root fibres, with great labour and much waste of material. Much more might be said concerning the manufactures and implements of these tribes, but want of space obliges us to pass on to a short description of marriage and burial ceremonies and religious beliefs.

In Mindanao polygamy prevails, the number of wives being limited only by a man's ability to purchase and maintain them, but in Luzon monogamy is the rule. In both islands the marriage tie may be dissolved after six months, on the ground of incompatibility of temper, or suspected barrenness. Adultery is severely punished, except among the Tinguianes, who can get rid of their wives with such ease, and take others, paying an indemnity to the injured husbands in the case of women already married, that they have practically all the facilities of polygamy. Except among this people the wedding is celebrated with a feast and dancing, and among the Bagobos the company squats round a symbolical marriage bed, surrounded by all kinds of household utensils, and sings hymeneal songs. In Mindanao, when a man dies his body is wrapped in a mat of *Pandanus* leaves, and is buried about a yard beneath the floor of the house, a slave being killed and laid beside him, if he be wealthy. All the household utensils are left in their places, and a supply of provisions, betel, tobacco, etc., is laid over the grave. The house is then deserted, and is soon hidden by luxuriant vegetation. On the island of Samal caves are used as burial-places, and, in Luzon, a hole is sometimes made in the side of a hill. In the latter island a great feast is held, and continued until all the cattle and provisions of the deceased are consumed. A symbolical sutteeism is observed among the Tinguianes, the wife lying during the feast, which often lasts nine days, under the same covering with the corpse. The natives of Luzon, influenced probably by aversion to the Spaniards, are very chary of giving information to any Europeans concerning their religious beliefs. The balance of testimony, however, in spite of what writers of native descent have said to the contrary, is in favour of the view that their religion is nothing but a worship of the spirits of the departed (Anitos), conducted on fetich principles—that is, they endeavour to propitiate the evil spirits, and ungratefully neglect the good. Offerings are placed in rooms attached to the house, or in rude temples, especially in times of sickness or other misfortune, and at their feasts provisions of all kinds are set apart for the spirits. The Mindanese, however, who in many respects seem to be superior to the people of Luzon, believe in the reward of the good and the punishment of the wicked in another world, and possess a complete mythology. They hold one very remarkable theory. The earth, they say, is fixed on a stake,

which a snake is constantly trying to push aside. Such devices to account for the suspension of the earth in space were formerly invented by all nations, but this is noteworthy, because it so nearly resembles the ash tree and serpent of the Teutonic myth. Their legend also of Daragao, the servant of the god of evil, who goes out hunting with two dogs, recalls the story of Hackelberg, our Herne the Hunter, a mediæval version of Wotan and the Walküren. A belief in witchcraft, omens, and love philtres, and superstitions of all kinds, some very like those prevailing in Europe, are common to all the tribes.[1]

Little need be said of the third division, the Moros (Tagals and Bisayas). They are Mohammedan Malays, who must have migrated to the Philippines long after their heathen fellow-countrymen, but were settled there when the Spaniards discovered the islands, and had Manila as their most important town. They dwell along the coast (the Bisayas in the central islands named after them), and are governed by pirate captains or heads of families (Paulimas), and have also religious chiefs (Panditas and Sherifs). They are a degenerate race, much addicted to opium, wives, and hazard. Both in times of war and peace vows are frequently made by individuals and groups of men to run amuck among the Spaniards, whom they cordially detest, and to whom they are a source of much trouble.[2]

The trade of the islands is in the hands of Chinese, who exchange with the natives iron, beads, stuffs, mirrors, and wire for honey, wax, rice, and materials made from Manila hemp, and also deal with the Moros. Trade is chiefly carried on by barter, but plates of Chinese porcelain are also used by the inland tribes as a medium of exchange, and money is taken by Christian natives and others, who are in closer contact with foreigners.

In addition to the animals already alluded to, wild goats are found in the mountains, and wild dogs are very numerous. Birds of many varieties are plentiful; eagles, falcons, pelicans, parrots, wild-ducks, quails, woodcocks, and humming-birds. Singing birds are scarce. Snakes, lizards, and reptiles of many kinds abound, and stinging insects are very troublesome. Locusts commit great devastation in the fields. The cayman lives in the lakes and rivers, and the sea yields abundance of fish, *bêche-dê-mer*, mother-of-pearl oysters, and tortoises. The mountains are rich in minerals. Coal, iron, copper, sulphur, alum, and gypsum might be profitably worked; galena, chromate of lead, and sulphate of zinc exist in Zebu and in Mount Tinga, in the province of Camarines Norte, Luzon; gold is found in the alluvium of the rivers. The forests contain a great variety of trees, yielding woods of divers properties and fruits, which would form an important article of commerce, if the natives were enterprising enough to fell and transport them. Among them are the coco and other palms, mangoes, planes, sandal-wood, logwood, ironwood, tamarinds, varieties of *Cordia*, *Terminalia*, and *Rhizophora*, ebony, cedar,

[1] *Mittheil. der k. k. Geograph. Gesellschaft in Wien*, Bd. xxx., Nos. 1, 2, and 3; *Zeitschrift für Ethnologie*, 1885, pp. 8 and 45; and 1888, p. 34.

[2] *Boletino de la Sociedad Geográfica de Madrid*, tom. xxii., Nos. 5 and 6, p. 315.

gums, spices, etc., besides those that have been already referred to.[1] With all these natural resources, not forgetting a remarkably fertile soil, these islands ought to be the most valuable of the foreign possessions of Spain. The exports, however, consist principally of sugar, tobacco, Manila hemp, coffee, indigo, mother-of-pearl, and tortoise-shell. The fall in price has considerably reduced the importance of the first article, and the tobacco has fallen off in quality through neglect, since the monopoly was abolished in 1883. The quantities of these articles exported are diminishing, and the trade in mother-of-pearl and tortoise-shell has almost disappeared from Manila, since free trade has been established in the Sulu Archipelago. The principal imports are cotton goods, most of them from England, cotton thread, textiles of hemp and flax, furniture, paper, cutlery, cast-iron, wire, paper, silk, drugs, etc.

The Ladrone, Caroline, and Pelew Islands, the archipelagoes of Sulu and Tawi-Tawi, and the small groups of the Batanes and Babuyanes between Luzon and Formosa, are united under one colonial government, the seat of which is at Manila. Here reside the governor-general, a commander-in-chief of the forces, who acts as deputy in the absence of the governor-general, a rear-admiral in command of the naval forces, and a chief secretary. A court of exchequer and criminal and civil tribunals are also established here, and the civil and military chiefs form a council which the governor-general may consult, when he deems it advisable to do so. As some parts of the archipelago are at a considerable distance from Manila, and the islands are not connected by telegraph cables, three presidencies have been established under the command of brigadier-generals, who are subordinate to the governor-general: namely, Mindanao, capital Zamboanga; the Bisayas, capital Zebu; the Caroline and Pelew Islands. Besides these, politico-military governors, as they are called, perform in the less civilised and important provinces such functions of government as are not discharged by special officials. The army consists of seven regiments of infantry, a squadron of lancers, and a battalion of engineers, which are commanded by Spaniards, Spanish artillery, and a civil guard (a kind of constabulary). There is also a corps of carabineers attached to the Customs. The rear-admiral, who is under the orders of the governor-general, but is independent in purely naval affairs, has under his control twenty-seven vessels of all classes and a regiment of marines composed entirely of Europeans. The religious needs of the archipelago are well provided for by priests and monks of the Augustine, Dominican, Jesuit, and other orders, under the supervision of four bishops and the Archbishop of Manila. There are also a few convents of nuns and sisters of charity.

The machinery, therefore, necessary for the government of these islands, the development of trade, the encouragement of agriculture and other forms of industry, and the work of civilising the native inhabitants, is not wanting. But what is the result of three centuries of Spanish rule? Don Canga-Arguëlles,[2] late politico-military governor in Palawan, acknowledges

[1] *Bulletin de la Société Royale Belge de Géographie*, 1888, No. 5.

[2] *Boletino de la Sociedad Geográfica de Madrid*, tom. xxii. p. 243.

how great the failure has been. Royal decrees, circulars and instructions of the governor-generals, dictating measures more or less judiciously adapted to promote the advancement of the dominion, have been rendered abortive by the incapacity of subordinate officials, who are slaves to routine, are unacquainted with the peculiar conditions of their districts, and show no energy in devising the means necessary for carrying out their instructions.

All the energies of the executive, Don Canga-Arguëlles affirms, are devoted exclusively to the collection of taxes, which, while pressing heavily on the poor natives, only just suffice to maintain the staff employed. These taxes consist, firstly, of poll taxes, for which the population is divided into eleven classes, the first nine paying from 1 piastre 50 c. up to 25 piastres (4s. 9d. to 79s. 2d.). The tenth class, composed of religious and charitable communities, soldiers, convicts, and paupers, and the eleventh, consisting of gobernadorcillos and other chiefs, their wives and eldest sons, receive their certificates gratis. The Chinese pay a capitation fee and a duty on their industry and commerce, but flourish in spite of taxation. A tribute is exacted from the heathen natives wherever it can be levied. Taxes on agricultural produce, 10 per cent., and of 5 per cent. on the annual revenue of urban property, subject to certain abatements and exemptions, and licences on professions and employments, complete the list of direct contributions. These licences must be taken out, among others, by persons engaged in the manufacture and sale of tobacco and alcoholic drinks. Custom-houses are established at Manila, Zebu, Ilo-Ilo (Panay), and Zamboanga. Indirect taxes are levied on opium and on cock-fighting, of which all the inhabitants of the districts of the coast are passionately fond, and by means of stamps of all kinds. The corvée, in existence when the Spaniards took possession of the islands, and retained by them, has been commuted for a money payment, from which all persons connected with the government or religious bodies are exempt.[1]

All these taxes produce barely sufficient to cover the expenses. The budget of Mindanao shows a deficit, and in that of the whole dominion, in 1886-1887, the surplus was due to the payment of arrears. Don Canga-Arguëlles finds fault also with the judicial department. The natives have never been thoroughly subjugated. Piracy was finally crushed only some twenty years ago; in 1872 a revolt broke out in Cavite, the chief naval station, about nine miles from Manila, and even in 1887 the Spaniards had to send troops to Mindanao and Sulu. The tribes of the interior are practically independent, and, where there is a gobernadorcillo recognised by the government, his power is much restricted by the elders of the village, so that he is little more than an intermediary between his people and the government. But this state of things the provincial judges ignore as far as possible, treating all alike as if they were really, and not nominally only, subjects of Spain, and by this means, and also by paying no regard to local customs and the character of the natives, often cause disputes, which alienate the natives and sometimes lead to serious results. Strange as it may appear, it is a fact that no Spaniard takes the trouble to learn native dialects, except the priests. They, therefore, have

[1] *Bulletin de la Société Roy. Belge de Géographie*, 1888, No. 5.

more influence with the people than the government officials, though even they cannot be congratulated on having attained any great success. Taxation has to a great extent paralysed their efforts, for conversion involves the payment of the Spanish imposts and total subjection to Spanish rule. In some places also the priests have been over-zealous.

Manila is a town of 115,670 inhabitants, situated on the bay of the same name. It has suffered severely from earthquakes on many different occasions, and therefore the houses are built of wood, which, though less affected by shocks, cannot offer as much resistance as stone to the violence of typhoons, another scourge of these islands. A telegraph cable connects Manila with Hongkong, and Spanish mail-steamers, steamers of the Messageries Maritimes, and many smaller British and Spanish vessels call here. Those of heavy tonnage have to anchor at Cavite. The chief towns of the other islands, Zamboanga in Mindanao, Calapan in Mindoro, Puerta Princesa in Palawan, etc., are comparatively insignificant. Ilo-Ilo in Panay has 12,000 to 15,000 inhabitants.

The maximum thermometric reading is 95° to 99°, and sometimes attains 104°; the minimum never sinks below 60°. The mean annual rainfall is 90 inches. The western coast enjoys a drier and more temperate climate than the eastern, owing to cool northerly winds. The climate may not be bad for these latitudes, but the temperature and the prevalence of malarial diseases show that it is of a moist, tropical, and enervating character. The salubrity of settlements may, however, be considerably improved by clearing the woods around them, as has been proved at Puerta Princesa.

Considering, then, the climate, earthquakes, typhoons, and the character of the natives, it must be evident that the Spanish Government has no easy task to accomplish, if it is to raise these islands to the position in the world of commerce which their natural resources qualify them to fill. Considerable economy might be introduced by diminishing the official staff and adding the duties of the discharged functionaries, often almost nominal, to those of the remainder, a proceeding which is generally unpopular. A better choice of ports might in some cases be made; for instance, in Mindanao, customs are levied at Zamboanga at the extremity of the western peninsula, whereas Misamis and Surigao on the northern side of the island are far richer and more productive districts than that of Zamboanga. Indeed, the existence of custom dues contributes greatly to retard the progress of these islands, driving away trade to neighbouring ports. Then, the aborigines must be thoroughly subjugated, for colonists cannot advance far into the interior as long as head-hunting is allowed to continue. No doubt, many of the natives would perish in fighting against the Spanish troops, and many more be carried off by the diseases which usually follow in the wake of European occupation, and are so fatal to barbarous tribes; but, considering that these islanders have acquired some skill in the useful arts and engage in agriculture, and judging from the example of the Christian natives, or Ilocanes as they are indiscriminately called by the Spaniards, it may be hoped that a better fate is in store for them than has befallen the American Indians, the Australian indigenes, and other nomad races. The Ilocanes and the

Moros are at present the chief producers of exported goods, the wealthier Moros cultivating their plantations by slave labour. These keep to their imperfect system of agriculture and the crops they have always been accustomed to raise, nor do they dream of applying themselves to new forms of industry. The initiative must therefore come from European colonists. Inducements have latterly been held out to colonists, who wish to settle in Mindanao, in the form of an exemption from taxes for the first few years, but it is also necessary to give them a fixed tenure of land. As it is, only those who are intelligent enough to be able to obtain a fair profit during the time they may remain in possession, venture to sink their money and spend their time in agricultural pursuits. There are extensive lands suitable to the cultivation of rice, cotton, coco, tobacco, and all the crops appropriate to these latitudes. In Panay some mines of lead and mercury are being exploited, and probably many more might be profitably worked. The large variety of woods has already been mentioned. But such undertakings require capital, machinery, and workmen trained to these particular industries, if they are to be carried on to the best advantage. It therefore behoves the Spanish Government to render the permanent settlement of European colonists possible, by establishing security and granting the necessary facilities for mercantile and industrial enterprises. Should it at last wake from its slumbers, and adopt an energetic and intelligent policy, flourishing communities will soon spring up on this hitherto neglected archipelago.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Dundee Branch of the Society held its opening meeting in the Kinnaird Hall on the evening of the 13th December last, Principal Petersen, Chairman of the Local Committee, presiding. A paper on the "History of Central Africa, Past and Present," was read by Colonel Sir Francis de Winton; it was illustrated by lantern views. Dr. Merry moved, and Mr. T. Davidson seconded, the vote of thanks to the lecturer.

An Ordinary Meeting of the Society was held in Dowell's Hall, Edinburgh, on the evening of 13th December. Dr. George Smith, C.I.E., presided. General Sir R. Murdoch Smith communicated his paper, published last month, on Telegraphic Communications with India. Sheriff Mackay conveyed the thanks of the Society to Sir Murdoch Smith for his Address.

Colonel T. Cadell, V.C., read the paper which we publish this month at a meeting of the Society held in Edinburgh, in the Freemasons' Hall, on Tuesday, 15th January. The paper was illustrated by lantern views. Colonel Dods, Member of Council, who presided, conveyed the thanks of the meeting to Colonel Cadell for his lecture.

A Joint Meeting of the Glasgow Branch of the Society and the Philosophical Society of Glasgow was held in the hall of the latter Society on the evening of the 23d January. Dr. J. B. Russell presided. A paper on "The Republic of Chile" was read by Mr. J. C. Rogers, Vice-Consul of the Republic, who received a vote of thanks on the motion of Dr. W. G. Blackie.

GEOGRAPHICAL NOTES.

EUROPE.

Observations of Temperature in Rivers.—At the instance of Dr. Mill, the Society's delegate to the Association of Corresponding Societies of the British Association in 1888, a committee, originally nominated in the previous year, was re-appointed to arrange for observations being made on the temperature of water in lakes, rivers, and estuaries throughout the United Kingdom. The committee[1] is composed mainly of meteorologists who have taken a special interest in the distribution of temperature in water; and action in the new series of observations was at once commenced. Preliminary observations made on several rivers in Scotland during 1887 showed that the temperature of river-water presented unexpected relations with the air temperature and rainfall, and suggested many points of interest inviting to further research over a wider area. The various local societies represented in the Association have been communicated with; several of them have obtained thermometers, and have arranged for regular observations being made on the streams or lakes of their neighbourhood, commencing on January 1, 1889. This is being done in England, Scotland, and Ireland; and although several independent observers have also commenced work in various places, there is room for many more in the accumulation of data which cannot be too detailed or comprehensive.

The committee, having received a small grant, defrays the carriage of thermometers, supplies full instructions for their use, and books for recording the observations, free of charge. The thermometers employed are also carefully compared and verified before being sent out, but the instrument itself is charged for at cost-price (2s. 6d.), except in special circumstances, when it may be sent free. Should the thermometer be broken, a new one is sent for 1s. 6d., the price of the instrument without the case.

Probably such trustworthy instruments have never been procured so cheaply before, and it is only possible to supply them at the price on account of the large number in use.

Gentlemen or ladies living near any river in the United Kingdom in which they would be willing to make observations daily for a year, or for a few months, could take part in this research with little trouble, and might be the means of materially promoting the objects the committee have in view. Application for further information will be gladly received by the Secretary of the Committee, Dr. H. R. Mill, 3 Glenorchy Terrace, Edinburgh.

German Empire: Population.—The results of the census of December 1, 1885, have now been published (*Statistik des Deutschen Reiches. Neue Folge*, Bd. 32). The *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* gives a few extracts. The total population is 46,855,704 over an area of 540,597 square kilomètres, or 224·5 to the square mile. The increase since 1880 amounts to 1,621,643, and the number of emigrants for this period is 980,215. If the towns be divided into classes, the first being those containing 100,000 inhabitants and upwards, the second from 20,000 to 100,000, the third 5000 to 20,000, and the fourth

[1] *Chairman*, Dr. John Murray; *Secretary*, Dr. H. R. Mill. *Members*—Dr. John Murray, Professor Chrystal, Dr. A. Buchan, Rev. C. J. Steward, the Hon. R. Abercromby, Mr. J. Y. Buchanan, Mr. David Cunningham, Mr. Isaac Roberts, Dr. H. R. Mill, Professor Fitzgerald, Dr. Sorby, and Mr. Willis Bund.

2000 to 5000, it will be found that Germany contained, in 1885, 21 of the first class, 116 of the second, 683 of the third, and 1951 of the last. Comparing these with the corresponding numbers of the census of 1871, it seems that population is becoming more and more concentrated in the large towns. As regards religion, 29,369,847 were Protestants, 16,785,734 Roman Catholics, 125,673 Christians of other sects, 563,172 Jews, and 11,278 belonged to other religions or were not classed.

The Rainfall of the Iberian Peninsula.—Records of rainfall in Spain and Portugal are not very numerous or reliable. The rain-gauge in towns is often placed on the roof of the house, while in the country it is close to the ground, and this difference of situation usually causes a difference in the quantity of rain caught. At some stations, rain observations have been recorded during a few years only, and must be corrected by the means of those of neighbouring stations. The results obtained from these records are as follows: the rain curve of 300 mm. (11·8 in.) encloses two small districts around Salamanca and Lerida; the curve of 400 mm. surrounds a stretch of country on either side of the Douro, and also runs from the Mediterranean round a large part of New Castile, La Mancha, a part of Murcia, and Valentia. The lines of 600 mm. (23·6 in.) and 800 mm. (31·5), starting from Capes St. Vincent and Roca, respectively, run parallel to one another northwards into Leon, thence eastwards and along the Pyrenees to the Mediterranean. The most rainy districts are those of the Pyrenees and the north-western corner of the peninsula, the plateau of Vizeu in Baira Alta, the north-western part of Galicia, and a small district in the Pyrenees, near the Bay of Biscay, having a rainfall of 1600 mm. (63 in.). It will thus be evident that, speaking generally, the rainfall decreases in amount from NW. to SE. The average rainfall for the peninsula is 633 mm. (24·9 in.). The monthly variation is much greater than in more northern countries—as much as seventy times, or even more, rain falling in the wettest month as in the driest. The highest records for a single month are found not in the rainy districts of the north-west, but in Jaen and Granada. On the coasts of Galicia and Asturias the number of rainy days in the year is about the same as in Berlin, while on the shores of the Mediterranean the number is about 40 to 50. It is singular that Salamanca, which has such a small amount of rain, records 87 rainy days.—*Herr G. Hellmann in Zeitschrift der Gesellschaft für Erdkunde zu Berlin*. Nos. 135 and 136, 1888.

The Rainfall of Hungary.—The climate of Hungary is very varied in individual parts, owing to elevation, geographical position, orography, etc., but, as a whole, it possesses the uniformity generally observed in continental countries. In the great plain this uniformity becomes monotony; between Munkacs and Croatia, ploughing, sowing, and reaping are carried on almost at the same time. In upper Hungary and Transylvania, on the other hand, almost every valley has a climate of its own. Fiume and the neighbouring coast has a maritime climate. The changes of temperature are remarkable in the inland districts, the thermometer rising or falling 22½° to 31½° F. in twenty-four hours, and in the great plain as much as 45° to 52°. The yearly variation is also extreme, both in low and mountainous districts, ranging from 120° to 126°. A tropical heat of 97° to 104° is often succeeded by an Arctic temperature of 22°. The repeated inundations in the valley of the Theiss influenced the Hungarian Meteorological Institution, in 1880, to establish additional stations for recording the rainfall in this district, and these are now forty-six in number. The minimum rainfall (13·9 in.) was recorded at Keresztur, in the district of Uvardhely, in Transylvania, at an alti-

tude above the sea of 1260 feet, and the maximum (91·6 in.) at Lokve, in the Fiume district, at an altitude of 2362 feet. In general, the greatest fall occurs in the north-east in the upper country of Marmaros, and in the coastal region around Fiume. The districts having less than 600 mm. (23·6 in.) are the plain of Pressburg and the Alföld—the large central plain. A comparison of the average annual rainfall of Hungary with that of other countries of similar conformation does not support the reputation for dryness which the valleys of the Danube and the Theiss have acquired. But if the variations in individual years be taken, the result is very different. Their range is as much as 36·6 per cent. of the rainfall.

ASIA.

Palestine : Meteorological Observations.—The observations, from which the following notes are taken, were recorded in 1880 by J. Dreher, at Sarona, a little to the north of Jaffa, and have been published in a tabular form by Mr. James Glaisher in the *Quarterly Statement* of the Palestine Exploration Fund, July 1888. The highest temperature occurred in May (103°), but 90° or more were registered in every month from April to November. The temperature was as low as 32° on three nights of the year, and below 40° on thirteen nights. The mean for the whole year was 66°·4. The daily ranges were large, varying from 15°·6 in January to 23°·9 in May. The mean monthly readings of the barometer show little variation, the highest being 30·046 in January, and the lowest 29·679 in July. The range of readings for the year was 0·780 in. The largest rainfall, 10·05 in., fell in December ; January and November show a great decrease, only 5·32 and 4·95 in., respectively. For 168 consecutive days, from May 2d till October 18th, no rain fell. The total for the year was 28·68 in. The most prevalent wind was the south-west, which was particularly frequent in June and July. Southerly winds, indeed, prevailed from June to October, and in January and December, while north-east and west winds prevailed in March. The quantity of water present in a cubic foot of air was as small as $3\frac{1}{4}$ grains in January, and as much as $9\frac{1}{4}$ grains in July. The degree of humidity was highest in January, 79 (saturation = 100), and lowest in May and August, 60. Other tables are added, showing the amount of cloud, observations of vapour, etc.

The Desert of Gobi.—Dr. Emil Deckert gives in *Globus*, Bd. liv., No. 22, a description of the conformation of the Desert of Gobi. It forms the eastern part of that vast sandy plain which extends from the Pamir plateau to the Khinghan Mountains. Under the 93d meridian of east longitude, the Kuen Lun and Thian Shan ranges, which bound the plain on the south and north, respectively, approach to within a distance of 200 miles. This narrow strait is the western limit of the Desert of Gobi proper. It is this part which Dr. Deckert treats of. Its total area may be estimated at about $2\frac{1}{2}$ million square kilomètres (973,400 square miles), and its greatest breadth between the Hoang-ho and the Yablonoi Mountains at about 1200 kilometres (745 miles). On the west it is divided by the Thian Shan and Altai ranges into separate bays, if they may be so named, of which the chief is the Dzungarian. To the south and east the limits of the desert are very clearly defined, but to the north and west a transitional zone exists. The whole region is a huge basin, having an average depth of 1000 mètres (3280 feet) in the central parts, and rising to 1500 mètres (4921 feet) at the edges. Certain spots lie much lower than the average level ; for instance, the surface of the Ebi Nor, in the plain of Dzungaria is only 213 mètres (699

feet) above the sea-level, and, from the observations of several explorers, it is evident that the desert may be divided into a higher main basin in the east, and a lower subsidiary basin in the west. The ranges of hills, which run across the desert, are of small relative height, and the surrounding mountains attain in parts only any considerable altitude. Nan Shan has an altitude of about 19,600 feet, Kinghan 8800, the Sayansk Mountains 11,400, and the Thian Shan over 20,000. These chains do not present a very imposing aspect from the Mongolian side, because they are observed from high ground, but they exercise a great influence on the climate, for the prevailing west wind can penetrate freely into the country between the chains running on this side from east to west, while the south-western wind is caught by lofty ranges. The former wind, blowing as it does from the centre of the old world, has great power of absorbing moisture, and thus preventing the formation of clouds, whereas the latter blows from the nearest coast, only some 250 to 300 miles distant, and is laden with moisture. Hence rain falls very seldom, and streams are rarely met with, though sufficient rain comes down at the end of summer to feed a few springs and salt lakes. The streams which descend from the mountains struggle in vain against the dry atmosphere, dry sand and gravel, and end sooner or later in a salt lake. The extremes of heat and cold show a wide range of temperature. The January isotherm of 14° F. runs along the southern boundary, and in summer 104° have been recorded. The day and night temperatures show similarly great differences. While, then, water has little share in modifying the surface of this region, except at its edge, temperature is a much more powerful and generally effective agent. If it be remembered that in Urga and Uliassutai the thermometer often sinks in January to the freezing-point of mercury, while in summer a tropical heat prevails, and that Przhevalski noticed a difference of more than 69° F. between the shade temperature on a certain day and that of the succeeding night, it will not seem surprising that the rocks of the low hills of the Gobi desert are riven and disintegrated to an exceptional degree by sudden contraction and expansion. The wind completes the work, whirling the most finely divided particles high into the air, and carrying them sometimes beyond the limits of the desert, and conveying sand and gravel to a longer or shorter distance in proportion to their coarseness. Hence three different regions are observable—the löss region, where the soil, in order to produce crops, only needs to be freed by more abundant irrigation from its excess of salt; the region of moving sands, and the flats of gravel and stone. The sandy regions (Tingeri) have earned for the Mongolian desert the Chinese name "Shamo," and the gravelly districts the name "Gobi." It is not surprising that the flora of the desert is poor in species and individual plants, but such as are able to defy the winds, frosts, scorching heat, and saline soil have a marked character. *Holoxylon ammodendron* grows on the sand-hills; *Nitracia Schoberi* and *Agriophyllum gobicum*, *Lasiagrostis splendens*, *Kalidium gracile*, and *Artemisia* in the briny löss soil. Trees, properly so called, are only to be found here and there in well-watered spots on the northern slopes of the mountains. Towards the west the vegetation becomes more luxuriant, owing to better irrigation. The fauna is naturally poor also. Przhevalski gives the number of the varieties of mammalia as 50; among them an antelope (*Antilope gutturosa*), a sand-weasel, and a sand-hare (*Lagomys Ogotono*) are the chief inhabitants of the wastes, and in the mountains the wild ass, marmot, wolf, and fox find a home. The domestic animals are the fat-tailed sheep, the dromedary, horse, and cow. Cattle-keeping is the chief occupation of the Mongol inhabitants, and their institutions are patriarchal. Several families unite together to form a village, and they are combined again to form tribes, etc.,

but the larger bodies have little cohesion. The population is, of course, denser on the border of the desert, and here the spirit of clanship is more alive. The Chinese, who are still looked upon as foreign usurpers, endeavour to promote the disunion, as being favourable to their authority.

The Population of Japan.—The statistics of population in Japan are discussed by Dr. K. Rathgen in the *Mitteilungen der Deutsch. Gesell. für Natur- und Völkerkunde Ostasiens*, vol. iv., No. 37. No regularly organised census has yet been taken in this country, but the numbers are extracted from the registers of towns and districts, compiled by the local authorities. These consist of three lists, in which are recorded, respectively, the persons who have their legal domicile in the place, the other inhabitants, and the absent natives. Many errors occur in these lists, but it seems probable that they counterbalance one another, and that, therefore, the total figures may be relied on. This opinion is justified by the number of households, which accords with the numbers given by the above lists. The total population of Japan from the census of 1885, the last of which the results are at present known, is 37,868,987, about the same as that of the United Kingdom. This gives a density for the whole country of 256 per square mile, or about the same as that of Italy. But in this calculation the extremely thinly peopled Yezo and the Kurile Islands are included, which form together nearly a quarter of the total area. If these be excluded, the density of population over the remaining islands is 339 to the square mile, a higher rate than is attained by the great European States. The province Gokinai has a population of 2,347,960, or 880 to the square mile. The second in density is Tokaido, with a population of 8,584,925, or 541 to the square mile. The other provinces are less thickly peopled than England; Hokkaido and the Bonin Islands very sparsely. Large towns are not numerous. On 1st January 1884, Tokio had 902,837 inhabitants, and Osaka, the next in size, 353,970. Three other towns, Kioto, Nagoya, and Kanazawa have above 100,000 each. As in Europe, more boys are born than girls, and the mortality is likewise greater among the former. On 1st January 1885, there were found to be 19,157,977 males living, and 18,711,110 females. This excess of males naturally excites suspicion, and it should be noticed that far more of the persons lost sight of, which are kept on the local registers up to 80 years of age, are men than women, though, of course, a slight excess is not incompatible with a higher rate of mortality. Records of births and deaths exist for the years 1876-85, but little reliance is to be placed on them. The means are 25·4 and 18·5 respectively—both low compared with the rates in European countries. After making allowance for errors in registration, Dr. Rathgen concludes that the excess of births over deaths during the year varies from $\frac{1}{2}$ to 1 per cent., an amount which, considering the present density of population, renders it probable that the Japanese will soon have to reclaim the lands of Yezo, or relieve the congestion by emigration.

The Meteorology of South-Eastern China.—Several tables of meteorological observations in this region have been sent to the Royal Meteorological Society by Dr. Doberck of the Hongkong Observatory. The observations of previous years, made at Chinese custom-houses and lighthouses, were not reliable on account of the inaccuracy of the instruments and the ignorance of the men to whom they were intrusted. The present observations, recorded in 1886, show a marked improvement. They have been registered at certain of the treaty-ports in China, and the instruments employed were of good construction, and were verified at the Hong-kong Observatory. Manila is included in some of the tables. The

mean barometric pressure for the year is highest along the river Yang-tse-kiang, and lowest in the Philippines. The annual variation is greatest inland, and least in the south-east. The gradients are steepest in January and most gradual in June. The highest mean temperature occurred in July and the lowest in January. In summer the temperature varies but slightly with the latitude, but rises in proportion to the distance from the coast. In winter the temperature is lower in the higher latitudes. The climate seems to be on the whole temperate, the highest monthly mean reading being 86°·7 at Pakhoi, and the lowest 41°·6 at Hankow. Both the direction and force of the wind depend on the distance from the sea. Along the Yang-tse-kiang the wind tends to blow in the direction of the river. The south monsoon, which occurs in July and August, has only about half the force of the north monsoon in winter. The northern entrance of Formosa Strait is the windiest place in the Far East. Last comes a table of the rainfall. This varies in amount from 134 inches yearly in northern Formosa to $\frac{1}{2}$ inch in Kiu-kiang. The winter is the wet season along the east coasts of Formosa and Luzon, whereas in China July is the wettest month.—*Quarterly Journal of the Royal Meteorological Society*, July 1888.

AFRICA.

Count Teleki's Discoveries in Eastern Africa.— To the *Times* of 26th December last, Count Teleki, the Hungarian explorer, contributes the following account of his recent discoveries, accompanied by the sketch-map which we reproduce. To save space we have omitted a few unimportant passages :—

The expedition left Zanzibar on the 23d of January 1887, on board the *Star*, one of His Highness the Sultan Seyyid Barghash's smaller steamboats, bound for Pangani. The expeditionary party, about 200 men, among them some old well-known fellows, who in their lives had walked more than once over unknown, unexplored countries, had been sent on three days before by an Arab dhow.

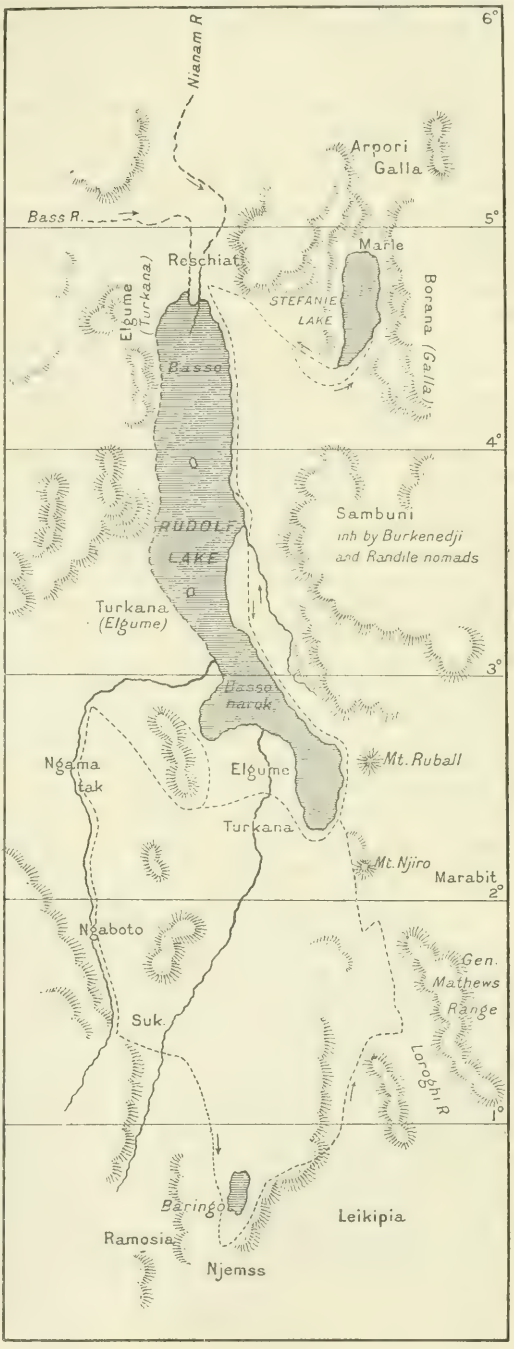
After having joined Jumbé Kimemeta, a well-known ivory-trader in the Masai country, who was engaged as interpreter, and having further engaged 100 men at this place—who were indispensable to travellers in these regions from their knowledge of the language and the very peculiar customs of the Masai—the expedition proceeded on the 4th of February, following the Ruon and Pare road up to Taveta.

Unable to carry all the loads, a good many of them were left behind in Pangani ; others were sent to Mombassa, where one can easily get sufficient porters for Taveta or Kilima-njaro, but to no further point.

In consequence of desertions we did not get to Taveta before the 30th of March. Here the expedition intended to stay for some time. Therefore, a place had to be cleared in the luxurious tropical vegetation, and houses and stores had to be built. Then, one party had to return and bring up the goods from Pangani ; another to Mombassa. Others were set to work to make about 100,000 necklaces of beads, and to sew 2000 "naibere," war-dresses of the Masai, who do not take any other cloth.

We ourselves, taking a small body of men with us, paid a short visit to the lower Kilima-njaro slopes, much molested night and day by heavy rains, being the rainy season. We went through the thick forest on the foot of Kilima-njaro, through Sigirari-Masai country, up to the Meru, coming back by Arusha and Kahe, fully satisfied with the splendid landscape, the wonderful vegetation, and the quantity of game of every kind. After a fortnight's rest, the rainy season not having quite passed, the ascent of the Kibo was tried, but we failed to succeed.

In the meantime the two parties from Pangani and Mombassa had come back, every preparation had been made, all goods packed in loads of 70 lb. to 90 lb., and as everything seemed sufficient for a year's travel in uncivilised Africa, Taveta was left on the 15th of July. The caravan consisted of 250 Swahelis, eight Somalis, and 23 donkeys, every man being well armed, and almost all overladen with goods and food. Travelling round Kilima-njaro's east side, we met the first Masai near Kimangelia, and then there arose that good feeling and sympathy which later on we always felt for them. After one month's journey through their country, possessing almost as many splendid hunting-grounds as camps, we reached Ngongo Bagass, a place on the southern Kikuyu frontier, where the caravans used to stop to buy food before they proceeded further on into a country abundant with ivory, but without any means to feed an expedition. From this place we intended to make our way towards the Kenia. Kikuyu we knew to be thickly populated by a dangerous people; dark forests enable them by day and night to follow the caravans, themselves under cover, threatening with their spears or poisoned arrows.



The accounts of the country we had had before starting proved to be pretty correct; the land is covered with plantations of all sorts of crops, and inside of their frontier there is no forest at all; but instead of being a quiet, agricultural population,

enormous quantities of sugar-cane are grown, allowing the people to be almost always drunk, which every minute endangers the peace. Surrounded by armed men numbering from 1000 to 2000, the caravan had to take its way over this well-watered, hilly country, never knowing when fighting might begin; but only on three occasions during our month's stay in that country blood had to be shed.

If the Kikuyu natives were less cowardly than they are, it would be a hard task for a small caravan to go through their country; but we safely reached their frontier—glad to be another time in absolute wilderness, not tortured by the yells of hundreds and thousands of natives—and marched to the foot of Kenia, that brother mountain of Kilima-njaro, as yet not ascended or explored. Three weeks—from the 8th of September till the 1st of October—the expedition stayed there; but only Count Teleki tried to climb up to the snow-clad crater of Kenia, the other members then suffering from sickness; 16,000 feet seems to be the average height of the crater, add to this 2000 or 3000 feet more for the inaccessible, rocky summit, and we have for Kenia almost the same height as Kibo. Thick forests, especially of bamboo, cover its gentle ascents up to 10,000 feet.

After this, the Baringo Lake was the next point of attraction. The expedition reached Njemss, the Wakuafi settlement on its southern side, in two parties, one party first trying to get to Lorián, but failing from want of food. Njemss was by no means the lovely resting-place we all had hoped, where the expedition might quietly stay for some 14 days, and its people get strong to enable them to endure the coming hard time; no food at all could be got there, neither in Njemss nor for 80 miles around. A party sent forward in search of food made us lose 20 days more, and came home with almost empty hands. Then it was determined to send 150 men back to Kikuyu, for large quantities were needed. All those days, during nearly three months, game, and game alone, was the only obtainable food; and game was there in never-dreamt-of abundance.

At last the caravan in search of food came back with about 100 loads, the least quantity that was needed; the men had become thin, weak, and worn out with hunger and fatigue, and had suffered much from cold. Miansini, about 8000 feet high, is by no means an agreeable place for people with only one yard of Merikani to cover themselves.

From the inhabitants only rough accounts of the country northward of the Baringo Lake could be got, which, moreover, were full of lies; but so much seemed to be true—that on the road to the big lake we should meet with scarcity of water, and should find difficulty in obtaining food.

Not before the 10th of February 1888 was the expedition able to move, after leaving behind the sick people, as well as the superfluous goods—which, without danger, might be left there. After 16 marches over the northern part of the Leikipia plateau, the Loroghi range, averaging from 8000 to 9000 feet in height, the Njiro mountain was reached; this is the most southern point, where the Burkenédji, a nomad tribe, are settled in small numbers. Here the difficult question of obtaining good guides was solved. After five more marches the expedition for the first time enjoyed the really magnificent look of the lake at its most southern part, and on the next day, the 6th of March, we encamped on the beach after a steep descent over volcanic rocks. The lake, called Basso Narók (Black Lake) by the inhabitants, probably on account of the bluish colour of its water, was named Rudolf Lake. The near surroundings of the lake, with almost no vegetation, were so bad that we could not think of leaving its borders. We therefore marched alongside it, not reaching the northern end before the 7th of April.

Only twice were natives met with; in the part to the south we found a very

small and mixed society of fishermen, who live near the beach on little islands, by fishing and off the meat of hippopotami and crocodiles which they may happen to kill. This colony consists of three different races—viz., Burkenédjis, Rándiles, and Gallas. Of their cattle they have all been robbed, and now are forced to live by fishing, as the country is unable to satisfy the wants of the most modest savage. The people we then met were the Elmolos of Reshiát, inhabitants of Reshiát and living in a somewhat better style. These people, too, being without possessions, have to take to fishing; by so doing they are able to obtain durrha by exchanging it for dried fish with men of their own tribe living only 60 miles further to the north. Thus they live a little better. This colony also does not count more than 60 to 80 souls, living on a sandy bank lying just above the level of the water. Fifty-four days had passed since the expedition left Njemss, and during the whole of this time we had solely to rely upon the stores carried with us, and upon our guns; indeed, had there not been such numbers of elephants, the expedition would not have been able to carry out its purpose.

The Gallas of Reshiát had plenty of durrha; they own immense herds of cattle and grey-coloured donkeys; yet, notwithstanding the abundance of goods which the expedition was carrying with it, nothing except durrha could be obtained in exchange; iron wire was perfectly worthless; copper and cottons almost the same; blue beads of the size of peas, and a much bigger kind, conical-shaped, irregular, roundish, were what their hearts desired; so we were beggars, for these kinds, high in prize here, were perfectly unknown to us. They must find their way through other Negro tribes from the Somali land, for caravans are quite unknown here.

Thence we went to the other lake, the Basso na Ebor (White Lake), further eastwards. Only during the rainy season is it possible to reach there and to make a stay, for the road thither is almost without water, and the water of the lake contains too much salt to be fit to drink. Although on its southern borders, Burkenédjis, and on its east borders, on the hills running parallel to it, Boranas are almost always said to be met with, no soul was seen, notwithstanding our search. Round the lake, to the Marlé living on its north side, we could not get. The western borders are not inhabited because of smallpox being there. This lake has been named Stefanie Lake.

Returning to Reshiát, we had, very much against our will, to march back on the same road, for, it being in the rainy season, the whole of the country to the north of the lake was flooded, the water being in parts 8 ft. deep. Besides, there were two large rivers which the expedition, with their boat lost, were unable to cross. We therefore returned in forced marches through the same dreary country. The porters carried heavy loads of durrha besides their other loads, for the oxen which we brought with us had a long time before been killed and eaten, and new ones it was impossible to obtain in exchange. Besides, during the time of the rainy season the elephants almost come down to the lake and had totally disappeared. Winding our way, closing round the southern part of the lake, round an active volcano, lying there, we in good time met the numerous herds of the Turkana (Elgume), a large tribe of nomads living on the whole of the western borders of the lake. Strange as was to them the sudden appearance of a caravan—they had never seen one before—yet soon they pretty quietly accepted the *fait accompli*, and even seemed to enjoy it. But even here our goods did not find the approval of their taste, for tobacco with them was the want, and only people carrying tobacco with them would have been able to buy cattle and camels, which they have in numbers. In exchange for beads and wire and such like, nothing but goats and sheep and

donkeys were brought. After a stay of several days for the provision of food, the dried-up bed of the Tirguéll river, the western frontier of this country, was reached.

We now had to march for eight days through absolute wilderness. It was impossible to buy any provisions, and, the game having sought other places because the river was dry, we had to live on berries and wild herbs alone. So we came to Ngaboto, a small settlement of Turkanas, living from agriculture. They could only give us little of their durrha crops just harvested. Further south, even that was not to be obtained, for the crops were still in the fields and unripe, and as there was no wild fruit, mushrooms and herbs were the only things that kept the men up. But this would not do long. The men losing strength more and more, some at length dying, knowing no other means to provide food, we took to the last means, and robbed a sufficient number of cattle from the nomads, who possessed herds of cattle, but on no account could be induced to sell. Then the misery was at end. On the 29th of July we safely reached Njemss, and took the easiest and nearest road, by Naivasha, over Kikuyu and Ukambani, to Taveta ; for the anxiety for food had become very disagreeable to us. At last we reached Mombassa, where the expedition arrived on the 25th of October 1888.

On the Scientific Results of Dr. W. Junker's Explorations in Central Africa.—Messrs. Justus Perthes, of Gotha, have issued, in the form of a double *Ergänzungsheft* (the first part of which, only, we have received), the scientific results of the explorations of Dr. Wilhelm Junker in Central Africa. The geographical data embodied in the large detailed maps[1] accompanying the text, and the collateral information which Dr. Junker and his assistants have thus given to the world, are of a very important character.

Dr. Junker's chief task is to describe in detail the hydrography, orography, and ethnography of the basin of the Kibali-Wellé-Mákua. For this purpose he occasionally oversteps the precise limits of the Wellé-Mákua territory, into portions of which (*e.g.* the basin of the tributaries of the Bahr el Jebel and the Bahr el Ghazál) his former explorations have led him.

The limits of the Wellé-Mákua hydrographic system are defined as follows. The eastern boundary is marked by the upper course of the Nile, the Bahr el Jebel, on about the 32d meridian of east longitude, and in the southern corner, in about 2° N. lat., by the western shore of the Albert Nyanza. In the west, this territory is bounded by the unknown lands extending between the 22d and 23d degrees of E. long. Captain Van Gèle navigated the Mobangi up to 22°, and broke new ground up to that point. North of this, within the same meridians, are the unexplored lands which compose the watershed of the Congo and Shari. Dr. Junker fixes as his northern limit the Bongo, Jur, and Kredj countries (about 8° N. lat.), whilst in the south the area of the explored territory is marked by the Népoko, in 2° N. lat. Thus, the territory under discussion stretches between the 23d and 32d degrees of E. long. and from the 2d to the 8th degree of N. lat. ; or between 9 degrees of longitude and 6 degrees of latitude ; embracing an area of 650,000 square kilomètres, or 100,000 square kilomètres larger than Germany. Of this area, some 250,000 square kilomètres are occupied by the basins of the tributaries which feed the Nile. The balance of 400,000 square kilomètres represents the area drained by the tributaries of the Congo, and is divided as follows :—Wellé-Mákua basin, 360,000 ; Loika-Itimbiri basin, 30,000 ; some

[1] By Dr. Bruno Hassenstein.

northern tributaries of the Népoko, 10,000. These estimates are, of course, only stated in round numbers.

Dr. Junker defines the water-parting between the Nile and Wellé-Mákua in the following terms:—From the district in which both rivers take their rise the water-parting runs to the NW., in 4° N. lat., through the territory of the Mundú. From about 4½ N. lat., under 30° E. long., it winds to the west nearly to 28° E. long. Not far from 29° E. long. it is strongly defined in parallel spurs of mountains, of which the highest is the Báginse. These uplands are drained towards the south-west by tributaries of the Wellé. From Mount Báginse, to the NE. and NW., flow tributaries of the Bahr el Ghazál. From 28° E. long. the water-parting runs almost due north up to 5° N. lat.; for half a degree north of Ndóruma's country it tends westerly, but, under 5° N. lat. and 27½° E. long., it resumes its direction due north. South of 6° N. lat. it is well defined as it crosses a ridge of mountains in the Pambía country and runs NW. as far as 26° E. long. and 7 N. lat. From about this point the water-parting is defined by a deep bend to the north, reaching to 8° N. lat. In the unexplored lands, under 23° E. long., the water-parting ceases to be between the basins of the Nile and Wellé: it divides those of the Wellé and Shari. Expressed in a few words, the water-parting between the Nile and Congo takes a north-westerly direction from 2° N. lat., west of the Albert Nyanza, to beyond 3° N. lat., then goes west for two degrees of longitude, and finally resumes its north-westerly direction as far as 24° E. long. and 8 N. lat. In only a few regions is the watershed marked by mountainous country: for the greater part it is scarcely distinguishable in the gentle upland country. Roughly speaking, the average altitude of the watershed may be taken at from 400 to 500 mètres, and its length at about 1200 kilomètres.

Before proceeding to examine its various tributaries, Dr. Junker refers to the sources of the Wellé and its course westwards. The name Wellé he applies to its entire length. "Kíbali" (="great river") is an expression of the A-Bángba; "Mákua" is the name given to the Wellé by the western A-Sandeh.

The sources of the Wellé lie between 2½° to 3° N. lat. and in 31° E. long., or about 50 miles west-south-west of Wadelai. The actual source, or main artery, is called the Kibi, which is fed by numerous water-courses from the northern spurs of the mountains west of the Albert Nyanza; flowing first to the north, it soon drains west, and maintains this course under the name of Wellé-Mákua, for as far as Dr. Junker followed it.[1] We have already referred[2] to the established identity of the Mobangi with the Wellé. The Wellé flows west for 1300 kilomètres of its course, with a divergence to the north of scarcely 1½°. To as far as Dr. Junker's westerly limit (Ali Kóbbo, 1025 kilomètres) the river has a fall of about 760 mètres. In its entire length of 2100 kilomètres, the Wellé is estimated to have a fall of 1000 mètres.

Our space will not admit of following Dr. Junker in his careful examination of the various tributaries of the Wellé; we must confine ourselves to general results, referring the reader to the original monograph for details.

The Népoko, or upper course of Stanley's Aruwimi, is referred to incidentally. Dr. Junker reached the river from the north in about 2° N. lat. and 28° E. long. Its course limits the boundary of our knowledge of the country immediately to the south of the Wellé.

In describing the physical features of the country, Dr. Junker gives us the information in sections: he refers to the various routes which he followed in the

[1] See *Scottish Geographical Magazine*, vol. iv. p. 211.

[2] *Ibid.* p. 330.

course of his explorations. Taking first the country to the north of the Wellé, he gives us, in reference to his journey from Dem Bekír to Ndóruma, a description of the country south of Dem Bekír. This country, which is hilly and covered with forests, obtains beyond the river Dschih a mountainous character, but for the most part it is undulating. In every district traversed by Dr. Junker, whether to the north, south, east, or west of the Wellé, this undulating character of the land was found to exist in a greater or less degree. His other journeys were: in the Makaraka countries east of Ndóruma, beyond the hydrographic basin of the Wellé; south-east of Ndóruma to the confluence of the Gádda with the Wellé; from Ndóruma SSW. to the Wellé; from Ndóruma west to Semio; from Semio SE. to the bend of the Wellé; from Semio south to the Wellé, near Bagbínne; from Urimdímma, *viâ* Bánsinge zariba to Ali Kóbbo, his furthest westerly point on the Wellé; and from the zariba Bánsinge, NNE. through Ombánga, to Semio. In the country to the south of the Wellé, his journeys were: from the zariba Hanásh, by Bakangaí and Kanna, to the station Tangasi; from the station Tangasi to the east, by Kúbbi, to the upper course of the Bomokándi and to the chief Madjégbae; and from the station Kúbbi to the south, by way of the Bomokándi, to Arama or Mbélia, Zanga, and the Népoko, and back to Tangási. In the more important instances, Dr. Junker gives us the altitudes above sea-level of the various districts. The mere enumeration of his journeys is sufficient to indicate the comprehensiveness and value of his work.

In discussing the ethnography of these countries, Dr. Junker refers only incidentally to the peoples north-east of the Nile-Wellé water-parting, in the country of the Makaraka and on the tributaries of the Bahr el Ghazal—a region previously examined by him. As a dividing line, he takes the natural barrier of the Wellé, though this river cannot be accepted as any definite ethnographical frontier. In consequence of the frequent wars, among other causes, the populations of Africa are constantly shifting their ground; a few years will result in most distinct changes. Strong Negro kingdoms can only be maintained by despotism. The traveller's observations are, therefore, always liable to revision shortly after they are made.

Of the tribes dwelling on the northern tributaries of the Wellé, the A-Sandé or Niam-Niam, is by far the most important. The A-Sandé kingdom occupies over a third of the area of the Wellé basin, and stretches to the NE., far beyond the Nile-Wellé water-parting. Dr. Junker estimates their number roughly at 500,000, or one person to the square kilomètre; but only the half of these are A-Sandé, the other half being composed of tribes who have been conquered or forced to colonise the country. From the fact of so many strangers occupying their territory, Dr. Junker infers that it is not the native land of the A-Sandé, and other indications are not wanting to strengthen this belief. The information given by Dr. Junker in regard to the A-Sandé and other tribes dwelling in the Wellé basin is most useful, though in too great detail for reproduction in these pages. Dr. Junker's valuable report is concluded by an examination of the meteorological and other observations carried out by himself and Emin Pasha.

MISCELLANEOUS.

A slight earth-tremor was felt in the neighbourhood of **Edinburgh** on the morning of 18th January.

Professor Schweinfurth left last November for Southern Arabia, in order to carry out further botanical explorations. His intention is to go from Hodeida to Sana.

Le Mouvement Géographique for 9th December 1888 gives a brief account of "the conquest of **The Congo**" during the last ten years. It is illustrated by maps.

The French traveller M. Trivier has left for the Congo and Stanley Pool in order to investigate, from that base, the problem of the **Lukuga**, the river which is the supposed outlet of Lake Tanganyika and flows into the Upper Congo.

Mr. Stanley's letter to Tippu Tib, announcing his arrival at Bonalya and his intention to start a second time, with Mr. Bonny and the remaining men and loads from the Yambuya camp, for Emin Pasha's province, has been received in Brussels. It confirms the safety of Mr. Stanley up to the middle of August last; his appearance is now looked for on the East Coast.

M. Pevtsow has been appointed to succeed the late General Przhevalsky in command of the Russian expedition to Central Asia and **Tibet**. M. Pevtsow has travelled extensively in Central Asia, and has done some excellent geographical work. Another expedition, under Russian auspices, is to be undertaken on similar lines to the above, but under the independent direction of M. Martin; its ultimate destination is Lhassa, and it is expected to be absent two or three years.

L'Afrique, quoting from the *Petit Provençal*, announces that **M. L. A. Brémond** is about to undertake an expedition to Shoa by way of Harar, which has recently been conquered by Menelek. By the assistance of this monarch he hopes to penetrate into Kaffa and the countries beyond, which a European has never yet visited. He hopes also to ascertain whether the Webi is really a tributary of the Jubà. It seems very doubtful whether M. Brémond will succeed, seeing that Dr. Traversi, who has been to Jimma, could not obtain permission to enter Kaffa.—*Bol. della Soc. Geog. Italiana*, October and November, 1888.

A useful summary of **Professor Schweinfurth's Expeditions in Egypt**, the Eastern Desert, the Great Oasis and Fayum, is to be found in vol. xv., No. 8, of the *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*. These journeys extended over fifteen years, beginning with 1874. The itineraries, the names of the publications in which the results were made known, and the museums in which the collections were placed, are all given, and Dr. Schweinfurth further informs his readers what works have yet to appear. This article should prove useful for reference.

A terrible famine in **China** is being experienced in consequence of drought and the recent inundations of the Yellow River. In the province of Ngan-Whi, the prefectures of Fong-yang, Ying-chow, and Si-chow are flooded by the Yellow River; in Kiang-su (the province in which Shanghai is situated) the crops have entirely failed from drought in the prefectures of Yang-chow, Chin-kiang, Soo-chow, and Chin-kiang, all of which appear to be the districts in the Yang-tsze Valley referred to in the first telegram. In Shan-tung and Manchuria there are extensive floods, and the area in which suffering prevails is described as immense.

A proposal is announced to improve the present existing canal between **the Clyde and the Forth**, so that ships might be able to pass through. The canal was constructed a century ago, and is 35 miles long, extending from Bowling on the Clyde to Grangemouth on the Forth—the line being almost due east and west—and there is a branch of $2\frac{3}{4}$ miles to Port Dundas in the north of Glasgow.

It rises 156 feet, and has thirty-nine locks. At the present time only very small craft can be passed through, not only because of the short locks, but also owing to the depth of water being only about 9 feet. It is proposed that it should be made suitable for sea-going ships.

The German mission-station at Tugu, fifteen miles west of **Dar-es-salaam**, where a majority of the slaves captured by the German warship *Leipzig* last December had been lodged by order of the German Consul-General, was attacked and utterly destroyed by the Arabs on January 13th. The station, which was entirely without protection, contained, besides the slaves, nine German missionaries, male and female. Of the latter, one is reported to have escaped, four were massacred, and the remainder were taken prisoners. The bodies of two men and one woman, Bavarians, were found barbarously mutilated with knives. All the slaves and the mission servants were carried away. As to the fate of the British and French mission-stations, the gravest apprehensions are entertained. The coast inhabitants are in a state of ungovernable irritation consequent on the continued fighting at Bagamoyo, Dar-es-salaam, and Saadani. A missionary, Mr. Arthur Brooks, is reported to have been shot by the natives at a place near the coast, where he had safely arrived after a journey of 500 miles.

NEW BOOKS.

Through the Heart of Asia over the Pamir to India. By GABRIEL BONVALOT. With 250 Illustrations by ALBERT PÉPIN. Translated from the French[1] by C. B. PITMAN. In two volumes. Pp. xxii., 281, 255. London: Chapman and Hall.

If the journey described in these volumes has not, for reasons we shall give later, all the geographical importance which the route taken by the travellers would have naturally led us to expect, the work is at all events one of much varied and sustained interest. It is a panorama of witty and life-like pictures of the scenes, many of them unfamiliar to us, through which the writer passed, and of the various classes and individuals with whom he was brought in contact. His generalisations, if rapid, are certainly acute: we may think his political conclusions tinged strongly by national prepossessions or prejudice, but the information recorded from personal observation, as well as from the characteristic conversations held with persons of all ranks and nationalities in the regions which have lately come under Russian influence, is full of interest. And as regards the natural features of the countries traversed, the copious illustrations, for the most part very clear and artistic, form a valuable supplement and commentary to the written description. The earlier stages of the journey, though considerable space is devoted to them, seem to have been traversed rapidly. The route was by the Caucasus line from Batoum *viâ* Tiflis; then leaving the railway before arriving at the Baku terminus, the travellers passed through the marshy fever-breeding country on the shores of the Caspian, with its miserable population—among whom was a party of banished Russian sectaries—to Resht, and thence to Teheran. We hear of no halts on the route, which was continued by "la grande route des armées et des conquérants" to Meshed. Commenting

[1] Gabriel Bonvalot. Du Caucase aux Indes à travers le Pamir. Ouvrage orné de 250 dessins et croquis, par Albert Pépin, avec une carte itinéraire du voyage. Paris: E. Plon, Nourrit et Cie.

on the passage through the famous defile between Veramine and Kishlak, which modern geographers are agreed in recognising as the Pylæ Caspiæ, through which Darius passed, with Alexander following, on his final retreat, M. Bonvalot takes occasion to say that he believes the said Pylæ to be "elsewhere." His only further apparent allusion to the subject, however, is when writing from Bostan, which, he says, if Pylæ means defiles, must be Hecatompylos. Bostan is, we believe, recognised as being very probably Hecatompylos ; but surely M. Bonvalot does not mean to identify Hecatompylos with the Pylæ Caspiæ ?

Familiar from previous journeys with the Central Asiatic steppe, the writer begins, soon after leaving Meshed, to recognise its characteristic features in the landscape along the course of the Keshef. The river has eroded its channel too far below the level of the country to have any effect on vegetation, and besides, " Ce sont les mêmes terrasses striées au bas de collines de grès sableux, mêmes schistes s'éffritant, saillant du sol et s'écaillant en minces lamelles. Près de l'eau, des selières touffues ; au milieu, des îles avec des fourrés, des bocages, des saules, des peupliers, des bouleaux. C'est la plaine Aralo-Caspienne, il n'y a pas à dire."

The author observed many signs of the happy change in the conditions of Northern Khorassan since it was freed from the incessant Turkoman raids by the Russian conquest of that people, but his verdict on the Turkomans' character is very favourable. He perceives that the " man-stealing " practices which made them notorious may be fairly attributed to external, and, so to speak, accidental conditions, and he credits them with many simple and manly virtues by no means common among their neighbours. And like other observers he recognises their value, disciplined and controlled, as Russian subjects. Crossing the formidable desert to the Bokharan oasis and Samarkand, the travellers struck south again, desiring to visit Balkh, but they were stopped on the Oxus by the Afghans, and returned to Samarkand by a more easterly route, through the hill country of Hissar and the neighbouring provinces formerly dependent on Bokhara and now consequently on Russia. The notices of the life and habits of the people here, and of the adventures and opinions of various dispossessed chiefs and others, are full of interest. But as a feat of travel, the interest of the work culminates in the succeeding part of the journey. The travellers wished to cross the Pamir into India. This was popularly supposed to be impossible in winter, but after full discussion of the difficulties it was decided, with the approval of their Russian friends, that it might be undertaken.

The Pamir, for those of us who gave any attention to the matter even little more than twenty years ago, will be remembered as a region of mystery, and the present occasion seems not inappropriate for tracing in a few sentences the progress of recent explorations there. Twenty-five years ago, then, we knew indeed that Marco Polo had crossed it, but of moderns we had only Lieutenant Wood's gallant dash through Wakhan and discovery of the Victoria Lake, while Fedschenko and Hayward, in their equally arduous explorations in the northern and in the south-eastern parts of the region respectively, had only formed some general conclusions as to its character. And on this head the luminous speculations of Colonel Yule, so generally confirmed by subsequent investigations, cannot even now fail to interest the geographical student. The special branch of Forsyth's Kashgar mission, told off for the purpose under Colonel Gordon and Captain Trotter, coming from Kashgar through Sarikol into Wakhan and the Great Pamir, determined various positions, as Tashkurgan, Yol Mazar, Kila Panjah and other places on the Panjah River, which were connected with the Russian

survey by the Russian expedition of 1883. Meanwhile new ground had been opened by our native Indian explorers, and the whole of the Pamir has in fact now been traversed in all directions by Russian *employés*, Severtsof, Regel, Ivanoff, and others. The extent of the region properly known as the Pamir may be defined as a parallelogram about 200 miles in extent from N. to S., by 170 from E. to W. Its limits on three sides at all events are well defined, for on the east it falls away abruptly down to the plains of Eastern Turkestan; on the north it has the Alai Range, and on the south the Wakhan valley; while on the west a line drawn northwards from the western limits of Wakhan separate its grass-covered mountains from the broken hill-country further west. It may then be considered a plateau, of which the valleys seem to be never lower than 12,000 feet, separated by ranges having a general NE. and SW. direction, several thousand feet higher. The valleys, like those of the Thian Shan, seem many of them to have contained lakes, the reservoirs for the drainage of the district, which are now drying up. The largest of these, Kara Kul, was described by the Chinese pilgrim Hwen Thsang in the seventh century to have an outlet both to the east towards Turkestan, and west into (probably) the Oxus. At present it is described as having no regular overflow, but there is every reason to believe that the Chinese traveller was right, and that at all events temporarily, in flood-times, if not permanently, there was an overflow in one direction or the other. The illustration of this lake and its neighbourhood in M. Bonvalot's book have thus a special interest.

M. Bonvalot testifies to the strange abundance of animal life in the shape of vast herds of Argals or mountain sheep, which seem able to sustain life with ease, probably owing to the nutritious character of the grasses during the spring and summer seasons, the same phenomenon being observed in the great plains of Western Tibet, which may in some sense be considered as a continuation of the Pamir. But other vegetation is almost entirely absent, excepting the willows and roses of the valleys, and a juniper, which probably furnished the "roots" which M. Bonvalot describes as constituting, along with the droppings of the animals, their only food.

There is still so much scope in the region for the intelligent explorer that we must regret that M. Bonvalot was obliged to cross it at a season when the country was all under snow, and offered consequently little opportunity for observation. The general reader will, however, find his consolation in the clear and humorous narrative of a gallant struggle with difficulties and privations of almost Arctic severity.

We have only space to add that under guidance and material aid from the Kirghiz under Russian influence, who were sent ahead to reconnoitre and clear the first stage of the route from snow, they entered on the Pamir near its NE. extremity, by the Taldik and Kizil-art passes, and proceeded southwards, transgressing on one occasion, unwittingly or otherwise, the Chinese frontier, where the official in command attempted to detain them. They, however, turned the tables on him, demanding a relay of camels, and thrashing him for not at once complying—a mode of obtaining their desires to which the party seems to have had frequent resort, encouraged thereto, no doubt, by its only too uniform success.

Having passed the famous natural bridge known as Tash-küprük, and failed, owing to the conditions of the snow, in a vigorous effort to cross over to Yasin, they passed down westwards into Wakhan, where they were again stopped by the Afghan authorities, naturally suspicious of the intentions, or perhaps the genuineness, of Feringhis who, though not English, professed great love for that

branch of the race, and who had, nevertheless, been more than half-identified with the Russians. They escaped, however, and crossed into Chitral by the Baroghil pass, where again detained by the natives, they owed their freedom and safety to the interference of Lord Dufferin, a service which is somewhat scantly acknowledged. Further details concerning this little-known region, and the route thence to Kashmir, would have been a welcome addition to the volume,—but we must be content with what we have got. We are not content, however, with the map, which for the important part of the journey, viz., the Pamir region, is on so small a scale as to be quite useless.

Nor can we say much in praise of the translation. Having compared it with the original we find misconceptions of the author's meaning not infrequent, and even down-right mistranslations, while from his treatment of the names of localities the translator would seem to have very hazy ideas on the geography of the region he is dealing with.

Sierra Leone; or, The White Man's Grave. By G. A. Lethbridge Banbury. London : Swan Sonnenschein & Co., 1888. *Price* 10*s.* 6*d.*

Mr. Banbury's book was originally written in the form of letters home, and it retains a good deal of the vivacity of correspondence. His boat touched at Goree and Port Bathurst, and it is only at p. 51 that the reader catches sight of Freetown and the Ridge of Lions. There is a short sketch of the early history of the settlement from the times of Granville Sharp, Falconbridge, and the Committee for the Relief of the Black Poor. The East African Company were unable to organise matters, and in 1808, the year of the Slave Trade Bill, Sierra Leone became a Crown colony. Mr. Banbury quotes from contemporary writers some frightful accounts of the sufferings of slaves. It was the policy of Sir C. M'Carthy and other early governors to put the liberated slaves to work at agriculture, but this policy has failed. When slavery was abolished by the British Parliament in 1834, Sierra Leone, of course, declined in importance. Mr. Banbury gives some amusing glimpses of life at Freetown. We wish he had given more examples of the Pidgin English of the place. "Does he lib (live)?" means, "Is he at home?" "What you come to take fire then?" means, "Your visit is to be a short one?" The work in the Secretariat and Treasury seems to be heavier than might be expected, and the frequent illness of officials makes an interchange of duties common. With the help of a small sailing-boat Mr. Banbury managed some wild-fowl shooting on the creeks, but the alligator seems to be too prominent a figure to make this altogether safe. The natives have a lively faith in witches, by which they mean medicine men and women. *Gregre* is the local word for fetich. The great heat at Freetown is somewhat alleviated by the quantity of delightful fruit which may be bought in the market. The appearance of the town is much spoiled by the unfinished state of the Wilberforce Memorial. Mr. Banbury suggests that it should be used as Government buildings, which are required for the concentration of official work. The garrison consists of a West India regiment, which is remarkable for its bad firing. Among the imports Mr. Banbury mentions "the vilest compound of trade spirits made expressly for the trade at Hamburg, and guns made from condemned gas pipes." Kola, an acid nut, and bungay or rotten fish, are favourite articles of diet with the natives. Our last movement in annexation in this part of the world was at the island of Kakonkeh, in the mouth of the Great Scarcies River. Sir Samuel Rowe seems to have acted with great prudence in this matter. Among the strange customs mentioned by Mr. Banbury are the Bundoo, or circumcision, and the semi-religious Porrah. The use of salt in the

hand when making an oath is characteristic of the Kroos. Sierra Leone has been called an epitome of Africa. Even during Mr. Banbury's short stay, he came into contact with Timanehs, Mendis, Soosoos, Ebos, Akus (the Jews of Africa), the Loubahs, and the Mohammedan Mandingos. The book contains an account of the expedition against Gbowe which Governor Havelock considered necessary to restore order in the Sherboro country. Although Mr. Banbury does not aim at a systematic account of the country, such as is to be found in the writings of Clarke, Horton, and others, yet what he says is bright, recent, and interesting. He makes no pretensions to scientific knowledge, but he is a sensible man, with some humour, who has kept his eyes open, and tells his story pleasantly. Unfortunately, he had the usual reason for leaving the White Man's Grave. As we go to press, the separation of Gambia from Sierra Leone for administrative purposes is announced. These changes have been too frequent.

The Kingdom of Georgia. Notes of Travel in a Land of Women, Wine, and Song; to which are appended Historical, Literary, and Political Sketches, specimens of the National Music, and a compendious Bibliography. By Oliver Wardrop. With Illustrations and Maps. London: Sampson Low, Marston, Searle, and Rivington, 1888. *Price* 14*s*.

The title-page of Mr. Wardrop's book on the *Kingdom of Georgia* is so compendious as almost to save the necessity of any further description of its contents. Neither the length of the author's stay in Transcaucasia, nor the extent of his travels in that interesting region, afforded him opportunities of making any fresh addition to our knowledge of the land and the people. He journeyed from Batoum to Tiflis, and from thence through the Pass of Dariel to Vladikavkaz; and afterwards made excursions to Signak, Telar, and other places in the beautiful country of Kakhetia. On these latter trips he makes the nearest approach to breaking new ground. But the story of his experiences was worth the telling, were it for nothing else than for the help it affords in bringing Georgia within the field of view of those who are in search of health, sport, picturesque mountain scenery, and novel customs and manners. "You can go from London to Tiflis, overland, in a week;" "it is a cheaper country to travel in than Scotland;" "it is at least as beautiful as Norway or Switzerland;" and there is no reason why it should not become as popular a resort as any of the three playgrounds of tourists that have been mentioned. This would, however, spoil one of the chief charms and advantages of Georgia—that it is as yet unbeaten and undiscovered ground for the holiday-maker; and it would probably spoil the Georgians also, who, according to Mr. Wardrop, are "a gay, open-handed, open-hearted, honest, innocent folk," to live among whom "is the best cure for melancholy and misanthropy that could well be imagined." Georgian history and literature, like the land itself, are untrodden grounds for the ordinary British reader and traveller. The glimpses of them which the author affords will create a desire to know more of so rich, ancient, and romantic a record. Mr. Wardrop is also strongly of the belief that Georgia has an important political future, as well as the prospect of commercial development and popularity as a tourist's, sportsman's, and mountain-climber's resort. A great change has taken place even since 1876, when Mr. Bryce's *Transcaucasia* appeared; a new feeling of unity has been awakened, partly through recent harsh measures of the Russian Government, culminating last year in the enforcement of military service. There is now "a politically homogeneous region stretching from the steppe of Baku to the Black Sea;" and diplomatists and statesmen have to count on the probability that "should Russia ever become involved in a great war, Georgia would declare her

independence, and endeavour to seize the Dariel Road; and the Armenians and Lesghians would also revolt, each in their own way." This is all very important —if true.

A Historical Geography of the British Colonies. By C. P. Lucas, B.A., of Balliol College, Oxford, and the Colonial Office, London. Vol. I. Oxford: Clarendon Press, 1888. Pp. 191.

Volume I. of Mr. Lucas's work amply fulfils the promise of his introductory volume, and justifies the praise which followed its publication (*Magazine*, vol. iii. 1887, p. 607). The colonies treated of are all small, and some of them we are apt to regard as unimportant, but many of these have had eventful histories. It is good to be reminded, for instance, how the keys of the route to India came into British keeping, what share of their ancient freedom or early prejudices their people still retain, and how those stations have grown in many instances from mere points of strategic importance into fields of commercial enterprise. It is good also to have such a compact, clear, and authoritative sketch of the topography of each of those regions as is here presented and illustrated by well-executed maps. The volume only includes the European and Asiatic colonies Heligoland, Gibraltar, Malta, the protectorate Cyprus, Aden, with Perim and Socotra, Ceylon, the Maldives, the dependencies in the Malay Seas, Hongkong, Mauritius and the Cocos Islands. We miss the story, dear to French geographers, as to how the perfidy (or promptitude) of the British commander at Aden prevented Perim from becoming a dependency of *la grande nation;* perhaps it is mythical. The clear type and orderly sub-division of the text give an air of grace and precision to the pages which is in thorough harmony with the remarkable grasp and force of the author, who seems to see exactly what is of permanent value, and to state it in perfect language. The happy combination of University culture and official information in Mr. Lucas, and his acceptance of assistance from specialists on the various colonies, make his book a very oasis in the desert of detailed geographical literature.

Great-Circle Sailing, indicating the Shortest Sea-Routes. By Richard A. Proctor. London: Longmans, Green and Co., 1888. Pp. 16, *double column.*

The late Mr. Proctor has laid the public under many obligations by popularising astronomy; here he does a work of practical utility which will live after him; and, if they please to employ it, will shorten the voyages and lessen the anxieties of sea-faring men. To find the shortest line between any two places on the earth's surface by means of flat maps, is a problem of considerable difficulty, involving mathematical constructions and calculations which deter many sea-captains from making use of great-circle courses at all. But the use of two charts drawn on a special polar projection, the nature and use of which are here described, enables the great-circle course between any two points to be laid down exactly by describing a single circle, from which as it cuts the meridians the correct course to steer at each point of the voyage can be ascertained as easily as the rhumb course is obtained from a Mercator chart. It is important to observe that composite courses can be drawn with equal ease, for few long sea-voyages can be made on a true great-circle course. The charts referred to, reductions of which are given in the book, appear to be all that is necessary for this direct system of navigation in any part of the world, and the well-known lucidity of the author's style will make their use intelligible to the slowest seaman who has passed his examination for "master."

Realistic Elementary Geography, taught by Picture and Plan. By W. G. Baker, M.A., Lecturer at the Training College, Cheltenham. London: Blackie and Son, 1888. Pp. 128.

A novel mode of treatment and a successful one is carried out consistently in this excellent introduction to Elementary Geography, the first part of what promises to be a valuable series. It begins at home, explaining directions on the earth's surface, and the meaning of maps, stating geographical definitions, with familiar examples, and goes on to trace briefly the form and chief divisions of the earth. Opening at random, we see the definition of *island* illustrated by a bird's-eye view (or a balloon-view as the author more happily puts it) of the Isle of Man, and beneath it a sketch-map of the island on a comparable scale. A town, a lake, a headland, a river, and many other features are treated in the same way. The book is intended for young children, and the style seems well adapted to the purpose, being conversational, racy, and simple. There are, of course, some points to which exception may be taken. For instance, at the very beginning: "If you walk out early in the morning just as it begins to be light, you may watch the sun rise. Look at that part of the sky where its light is first seen. That direction is east." This is true for the British Islands—and the book is written for use in England exclusively—only on two days in the year; and in the north of England the divergence from the east of the place of sunrise is very great in summer and winter. Several of the definitions are inaccurate, sometimes from the effort after simplicity; but the faults are all of the innocuous kind that can be detected and corrected by a well-instructed teacher.

Elementary Theory of the Tides. By T. K. Abbott, B.D., Fellow and Tutor, Trinity College, Dublin. London: Longmans, Green and Co., 1888. Pp. 41.

This little work gives a concise explanation of the chief theorems regarding tidal motion, with the minimum of mathematics. No subject in elementary geography is so difficult as the tides, because no subject is less understood. A careful perusal of Mr. Abbott's pamphlet will therefore be found peculiarly useful by all who have neither ability nor inclination to follow mathematical analysis, and particularly by teachers who wish to master the facts, in order to impart them.

Pictures of Native Life in Distant Lands. London: George Philip and Son, 1888. *Price* 7*s.* 6*d.*

This is a capital publication; well adapted for use in the schoolroom or as a gift-book. It consist of twelve coloured plates, illustrating the typical races of mankind, cleverly and dramatically designed by H. Leutemann, and reproduced in good taste by G. Löwensohn. To each plate is appended a descriptive sketch by Professor Kirchoff (translated by Mr. George Philip, jun.), which affords well-selected information regarding the people and country depicted in the illustration. The book is admirably adapted to convey a vivid impression of the leading characteristics of the most typical peoples, and, from its artistic get-up, is made most attractive to the reader.

Whitaker's Almanack. 1889.

This useful handbook continues to increase in size and scope. Several new articles have been added, and the remainder have undergone comprehensive revision. The article on "Geographical Progress during 1888" is a masterly review; it is fuller and better than any previous one we have seen in the Almanack. It is, however, disfigured by a few slight errors in the spelling of place-names.

NEW MAPS.

EUROPE.

EUBÖISCHEN EURIPUS, Tiefenkarte des ——. Von Prof. Dr. O. Krümmel. Massstab, 1 :314,000. Nebenkarte der Chalkidische Euripus. Massstab, 1 :72,000. *Petermann's Mitteilungen, Jahrgang* 1888, *Tafel* 20. *Gotha : Justus Perthes.*

FRANCE, Spécimen de la Carte de la Répartition Géographique ou Densité de la Population en ——, par Victor Tarquen.

Bulletin de la Société de Géographie, Paris, 1888, *Trimestre* 3.

ASIA.

L' INDO-CHINE, Carte de ——, pour l' intelligence, du voyage de M. Camille Gauthier au Laos ; à l'échelle, 1 : 5,000,000.

Bulletin de la Société de Géographie Commerciale de Paris, No. 1, 1888-89.

TENASSERIM, Itinerario di Leonardo Fea nel ——, publicato sugli schizzi del viaggiatore per cura di G. Dalla Vedova. Scale, 1 : 1,000,000.

Bolletino della Societa Geografica Italiana. Luglio, 1888.

KARIMON, Kaart der Chineesche Vestigingen in de Afdeeling ——, door A. F. P. Graapland. Schaal, 1 : 80,000.

Bijdragen tot de Taal-Land-en-Volkenkunde van Nederlandsch-Indië, 1885, *4th Aflevering.*

NORTH-BORNEO, A Map of British ——. Compiled from the English Admiralty Charts, and from the surveys and explorations of Messrs. F. X. Witti, W. B. Pryer, F. Hatton, Henry Walker, and D. D. Daly, in the service of the British North Borneo Company. Scale, 1 : 640,000.

E. Stanford, London, for the North British Borneo Company, 1888.

AFRICA.

CENTRAL AFRICA, Originalkarte von Dr. W. Junker's Forschungen in Central-Africa in den Jahren 1877-1878 und 1880-1885. Nach den Tagebüchern, Kartenskizzen und mündlichen Mitteilungen Dr. Junker's, sowie nach allen vorhandenen Quellen entworfen und gezeichnet von Dr. Bruno Hassenstein. Massstab, 1 : 750,000. (Pt. I.).

Petermann's Mitteilungen, Ergänzungsheft, No. 92.

CENTRAL AFRICA, Das Gebiet der Baschilange-Stämme. Von Premierleutnant Wissmann. Massstab, 1 : 1,300,000.

Petermann's Mitteilungen Jahrgang 1888. *Tafel* 21. *Gotha : Justus Perthes.*

CAMEROONS, Weg Dr. Zintgraf's u. Lt. Zeuner's bei dem Vorstoss von der Barombi-Station nach der Landschaft Banyang. Massstab, 1 :770,000.

Mitteilungen von Forschungsreisenden u. Gelehrten aus den Deutschen Schutsgebieten, 1888, *Heft* 4.

CONGO, Carte de la Région des Chutes entre Matadi et le Stanley-Pool, par A. T. Wauters, 1 :600,000. Avec trace du Chemin de fer.

L' Afrique, 1889, *No.* 1.

EAST AFRICA, Graf Teleki's Expedition-Routen in Leikipia. Von L. Ritter von Höhnel. Massstab, 1 : 463,000. *Mitt. d. K.K. Geo. Ges., Berlin*, 9, 1888.

LE SAHARA OCCIDENTAL ET LE SUD MAROCAIN, Itinéraires à travers ——. par Camille Douls, 1887. Echelle, 1 : 2,200,000.

Bulletin de la Société de Géographie, Paris, 1888, *Trimestre* 3.

MADAGASCAR, Itinerari di Due Viaggi al ——, eseguiti dall' ingl. E. Cortese, nel 1887. Scale, 1 : 1,000,000.

————, Carta dell' Isola ——. (Geological). Scale, 1 : 8,000,000.

Roma: Bolletino della Societa Geografica Italiana, Octobre-Novembre 1888.

MITTLEREN KONGO, Karte des ——. Auf Grundlage der Original-Skizzen der Oesterr. Kongo-Expedition, aufgenommen von Dr. Oscar Baumann, mit Benutzung der vorhandenen Quellen entworfen und gezeichnet von Paul Langhans. Massstab, 1 : 4,000,000. Blatt, Nebenkarte : Der Stanley-Pool, 1 : 2,000,000.

Wien : Mitteilungen der K. K. Geogr. Gesellschaft, Nos. 10 *und* 11, 1888.

TOGO, Übersichtskarte von dem Hinterlande des Deutschen Schutzgebiets. Nach den Aufnahmen C. v. François', 1 : 2,225,000.

Mit. v. Forschungsreisenden, etc.

NIGER DELTA, Map of the ——. By H. H. Johnston, H. M. Vice-Consul. Scale, 1 :1,350,000.

Proceedings of the Royal Geographical Society, December 1888.

RED SEA AND CAPE GUARDAFUI, Meteorological Charts of the ——. By General R. Strachey.

Proceedings of the Royal Geographical Society, November 1888.

SOUTH-WESTERN MOROCCO, Map of ——, illustrating Mr. Joseph Thomson's Journeys, 1888, compiled from his original surveys, collated with the work of other travellers. Scale, 1 : 1,020,000.

Proceedings of the Royal Geographical Society, January 1889.

NORTH AMERICA.

BAFFIN LAND, Die Eisverhältnisse des südöstlichen Teiles von ——. Von Dr. Franz Boas. Scale, 1 : 6,000,000.

Petermann's Mitteilungen Jahrgang 1888, *Tafel* 18. *Gotha : Justus Perthes.*

SOUTH AMERICA.

SIERRA NEVADA DE SANTA MARTA, Karte der ——, von Dr. W. Sievérs. Massstab, 1 : 500,000. Tafel 1. Geognostiche Karte der Sierra Nevada de Santa Marta. Von Dr. W. Sievers. Massstab, 1 : 500,000. Tafel 3.

Zeitschrift der Gesellschaft für Erdkunde zu Berlin, 1888.

VENEZUELA, Der See von **TACARIGUA** und die Eisenbahn nach Puerto Cabello, ——. Von Ernst von Hesse Wartegg. Massstab, 1 : 420,000.

Petermann's Mitteilungen, Jahrgang 1888, *Tafel* 19. *Gotha: Justus Perthes.*

AUSTRALASIA.

BISMARCK-ARCHIPELAGO, Gazelle-Halbinsel und Neu-Lauenburg. Massstab, 1 : 160,000.

Nachrichten aus Kaiser-Wilhelms-Land u. den Bismarck-Archipel, 1888, *Heft* 2.

KEY ISLANDS, from a Survey by Captain A. Langen. 1888. Scale, 1 : 510,000.

Proceedings of the Royal Geographical Society, December 1888.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ISLANDS OF MELANESIA.

By R. H. Codrington, D.D.

(*Read at Meetings of Society, Edinburgh and Glasgow, February* 1889.)

The name Melanesia has been given to a considerable portion of the West Pacific, extending from New Guinea to Fiji, and from the Equator to nearly the Tropic of Capricorn. My own knowledge of this island region is confined within much narrower limits; I have only seen and visited the Solomon Islands, as far as Ysabel, in about 7° S., the Santa Cruz group, the Banks' Islands, the New Hebrides, and the Loyalty Islands; and with the southernmost of these I have little acquaintance. But I have several times passed through these groups, coming up from New Zealand and Norfolk Island; coming first upon the coral terraces and stiff upstanding pines of the Loyalty Islands, and then crossing to the islands of the New Hebrides, whose volcanic origin is unmistakable, in which and the succeeding groups active volcanoes are never long out of sight.

I. Discovery.—The history of the discovery of these islands is certainly very interesting. We owe the knowledge of them to Spanish, French, and English voyagers, whose explorations from first to last have stretched through three centuries. To the Spaniards we owe the discovery of the Solomon Islands, the Santa Cruz group, the Banks' Islands, and the Northern New Hebrides. The French added, much later, to the discoveries of the Spanish. The English found the great mass of the New Hebrides and New Caledonia, and have filled with lesser discoveries the charts of all the groups. The Dutch discovered Fiji.

The earliest, and certainly the most interesting, discoveries were those of the Spaniards; the two voyages of Mendana, and that of Quiros and Torres. The recent work of Dr. Guppy has related and discussed at length the discoveries of Mendana as told by Gallego. For my own

part I must say that, except in the nautical particulars in which I am by no means at home, I do not recognise in this Journal of Gallego anything more valuable than what has before appeared in the collections of Burney and Dalrymple. If the Journal were one contemporary with the voyage it relates, its authority would of course be beyond question; but I am convinced that it was written, in the form in which Dr. Guppy gives it, long after. A proof of this appears to me in a single word. A chief of the first island discovered in the first vogage, Ysabel, "is termed in the Journal the Taurique Meta." But Taurique is evidently Te Ariki, in the common Polynesian language of the E. Pacific, "The Chief:" and in the account of the second voyage of Mendana, more than a quarter of a century later than his first, we are told that the chief of the newly-found Santa Cruz, Malope, called himself Taurique (Te Ariki), using the word used at the present day in the neighbouring Reef Islands. The Journal of Gallego therefore introduces in Ysabel in 1567 a word "Taurique" heard in Santa Cruz, where it is heard now, in 1595; and it cannot, I think, be taken to be more than a composition made long after the events it records, though it contains, no doubt, much noted down at the time.

Mendana then, despatched by the governor of Peru, came down in 1567 upon the great island of the Solomon group to which he gave the name of Santa Ysabel de la Estrella, the first Melanesian land known to Europeans. From thence the voyagers under his command discovered and named the great islands Malaita, Guadalcanal, San Cristoval; with the lesser islands, Savo, unmistakably that then named Sesarga, Florida with its islets,[1] Ulawa, and the lesser islands near San Cristoval.[2] There is, naturally enough, a good deal of difficulty in fitting the names given by the Spaniards to the islands and parts of islands seen by them as they cruised about; but there is no doubt that the islands then discovered are those which form the SE. part of the group to which Mendana himself gave the name of Solomon. I will now touch upon one or two points of interest which present themselves when one compares the present, or very recent, state of things in those islands with that represented by these earliest discoveries. It must be understood that in the 300 years that elapsed between Mendana's discovery in 1567 and my own first visit to these islands in 1863, there had been nothing, or almost nothing, done by European voyagers or traders to influence the character of native life. It is most interesting to inquire whether the natives of the latter part of the nineteenth century are the same as those found in the same islands in the latter half of the sixteenth century. We have, it is true, to allow for errors of observation and description, for faults of memory, for embellishments and exaggerations; but still the account of Mendana's first discoveries is historical.

Place-names.—It is well known to be a difficult thing to obtain on a first visit the true native names of islands, especially of large islands,

[1] Buena Vista, which is Vatilau; San Dimas, San German, Guadalupe, not ascertained.

[2] Das Tres Marias, 3 Sisters, Olu Malau; San Juan, Ugi; Santa Ana, Owaraha; Santa Catalina, Owarii.

and of villages or landing-places. The inquirer is pointing to the island as a whole, and is given the name of the district opposite him; he obtains the name of an islet between him and the main land; he mistakes the name of a man for that of the village where he lives. Large islands generally have no native name at all. We should not then expect to find many place-names now recognisable; but there are some in the Spanish account of the discovery about which there can be no doubt. The great island which I have been accustomed to hear called Malanta, had, according to the Spaniards, the native name of Malaita. At the present day it is called, all along its western side at any rate, by the one name of Mala, or Mara; a singular thing for so large an island. Beyond the south-eastern end of Mala lies what is now called Ulawa, plainly the name written by Gallego Uraba. This is particularly interesting, because the interchange of *l* and *r*, *b* and *v*, which belongs to the Spanish language, is carried to confusion by the natives of this island. The Spaniard, at any rate, did not fall into the common mistake of hearing and writing Ulaua. The large island to which the Spaniards gave the name of San Cristoval, or Cristobal, has no native name, but is best known by the name of that part of it, the mountainous mass of which is most conspicuous at a distance, Bauro, which is no doubt represented by Gallego's Paubro. Of the two islets which lie off the eastern end of this large one, Gallego names one Aguare. The Spanish *gu* represents *w*; the true name of the islet is Owarii, which is much better represented by the Spanish Aguare than by the Yoriki of the charts, or the Orika obtained by Dr. Guppy, probably from a resident trader. There is, besides, the name of Sabo, misapplied, but doubtless that of the island now called Savo. We may conclude, then, that the names of the Solomon Islands generally have not changed. Very few native words are given—chiefly names of persons. It may be said that these personal names are such in form as are heard in these islands now. Gallego gives apparently only one native word not a name. He speaks of the *benaus*, *panales*, *panays*, which are no doubt the *pana*, a kind of yam with prickles on the vines.

Weapons.—In the use of weapons, if Gallego's account is correct, there must have come about a considerable change. The natives are represented as attacking the Spaniards with bows and arrows, though darts are spoken of in San Cristoval. Within the last twenty-five years no visitor to those parts of the Solomon Islands would have seen bows and arrows used in fighting, except in Malaita. The natives have bows, but their fighting weapon is the spear. Their warfare is Homeric, an occasional bowman lurks behind. At Ulawa, Gallego speaks of the natives coming on with their shields, which do not go with bows and arrows. In this matter I have little faith in Gallego.

Cannibalism was evidently practised according to the Spanish account. In Ysabel and Florida it would not be seen now by a voyager; what there has been there of late years on the coast would never be conspicuous; in San Cristoval it would be observed.

Nakedness is said by Gallego to have been complete; Figueroa says the people wore something. At the present time, except in Malanta, absolute nakedness would not be found.

I conclude that the population found by the Spaniards is the same as at present, and that there has been no change in their condition and habits, except perhaps that the use of the bow in battle has been superseded by that of the spear.

I come now to the second voyage of Mendana, undertaken in 1595 for the colonisation of the Solomon Islands, and resulting in the discovery of Santa Cruz. An attempt was made to form a settlement; but the death of Mendana, and the general sickness of the party, caused the abandonment of the project after two months. We have ample details of this visit, and it is remarkable in this case how the account given corresponds with what is now observed. It is only within the last few years that, by the courage of the present Missionary Bishop of Melanesia, Bishop John Selwyn, the island of Santa Cruz has again become open to friendly approach. Bishop Patteson had before noted, in his visits of but a few minutes on shore, that all was as Mendana had seen it. After the first discovery, Carteret was apparently the only voyager who approached these islands. When they had been again visited, the death of Bishop Patteson, and of Commodore Goodenough not long afterwards, at the hands of the natives, shut out friendly communication for a time. They are now open again, and I have examined the narrative of Mendana's visit to these islands with natives of the group, whose comments were certainly interesting. I will mention one singular point. The Spaniards, failing in getting the people of the main island of Santa Cruz to learn their language, sent to kidnap (after the fashion so constantly practised) some boys from the neighbouring Reef Islands, whom they thought they had observed to be more intelligent than those of Santa Cruz. When I related this to a mixed group of Santa Cruz and Reef Island boys, I was assured that the Santa Cruz people still consider the Reef Island boys sharper than their own, because it is the custom of their fathers to take them with them on their voyages. There has been a certain inclination to ascribe to this short stay of Spaniards in the island the introduction of the loom with which they weave their mats, and of anything else in which a difference is observed; but all these things appear in the Spanish narrative.

The third Spanish voyage was that of Quiros and Torres in 1606. Quiros, who had accompanied Mendana, had still the object of recovering and colonising the Solomon Islands. Fortune, however, made him the discoverer of the New Hebrides, where he believed himself to have found the great Australian Continent in the island which now bears the name he gave of Espiritu Santo. Before, however, he had discovered anything considerable, he had obtained information at Taumaco from the natives concerning as many as sixty islands known to their voyagers. Some of these are easily identified—Sikaiana, Stewart Island; Tokelo; Nupani, Pileni, Reef Islands near Santa Cruz; Manicolo, no doubt Vanikoro, the scene of the wreck of La Pérouse; Tucopia, properly Chikopia; Guaytopo, Waitopo. All these are islands inhabited by people of Polynesian race, great voyagers, to this day retaining their Polynesian tongue, though

where they lie nearer to large islands of Melanesian population, they have lost their distinctively Polynesian physique. Among the names of islands known to Taumaco navigators is Pouro, in which one is at once disposed to find the Bauro of San Cristoval. But certain arrows were described as brought from thence, which in these days, at least, would have a more likely origin in the New Hebrides, with which, I think, they must have been acquainted. We are told, moreover, that Quiros understood at Taumaco that they were acquainted with Santa Cruz.

At any rate the information he received led Quiros to seek for the large island he hoped to find in the south; and his discovery of Espiritu Santo was preceded by that of the Banks' Islands, as they were afterwards named by Bligh, one of which, Santa Maria, still bears its Spanish name; the others, probably including Aurora of the New Hebrides, were San Raymundo, Los Portales de Belen, La Vergel, Las Lagrimas de San Pedro, El Pilar de Zaragoza, probably Mota, and Nuestra Señora de la Luz, now Star Island, Merlav. When Quiros and his companion Torres parted at Espiritu Santo, the latter saw the group of five islands which are known as the Torres Islands.

The French expedition under Bougainville, in 1768, added Aurora, Pentecost, Lepers' Island, and Malikolo to the known islands of the New Hebrides, called by him the Great Cyclades, and afterwards the great islands of Choiseul and Bougainville to the Solomon group. In the next year Surville passed through the Solomons without fresh discovery. The disastrous voyage of La Pérouse followed in 1785.

In his second great voyage in 1774, Cook filled up most of what was unknown of the mass of Melanesia by his discovery of the Southern New Hebrides, the Loyalty Islands, and New Caledonia. Bligh, in his wonderful boat voyage after the mutiny of the *Bounty*, passed through and named the islands of the Banks' group. Fiji had been long before discovered by the Dutch.

It may be reasonably supposed that the readers of the narratives which relate to us the discovery of lands and people hitherto unknown, must sometimes pause to wonder what the people discovered thought of their discoverers. To the Spaniards of the sixteenth century, and to the English of the eighteenth, that there should be new islands and new nations in the distant ocean was nothing surprising; they would indeed have been surprised if none such had been found. But these new-found people, wholly ignorant of the great world to which they belonged, what did they think of these strangers? We have the narratives of the discoverers, who as freely as their successors, even unfortunately to the present day, put down to the treachery of the natives every conflict that arose. We have, however, in some cases at any rate, two accounts; for example, in the first voyage of Mendana, the treacherous attack of the natives of Guadalcanar, according to one narrative, is shown by the other narrative to have been, in fact, the angry assault of those whose sons and brothers had been kidnapped by the Spaniards. But it is plain that the natives

were generally at first friendly, and often afterwards—we may suppose sometimes without provocation—hostile. I think that we may understand the attitude of the native mind. There are many Melanesians of whom it is now easy to inquire what they thought of the first white men who visited them. They will, in many cases, answer that they thought they were ghosts. And we must remember that they knew of no other men but themselves, and supposed, therefore, that there were no other ghosts than those of their deceased fellow-countrymen. I have been taken for a ghost myself. It is true that Melanesians, like other people, have a dread of ghosts; but still, as Melanesians generally look to the ghosts of their deceased great men as the objects of their worship, it is natural that they should receive them with respect and in peace. But it cannot be long before it becomes clear that these are not ghosts at all. What are they, then?—men? No; for if they were men they would be black; if they were men they would belong to the world, and these have come from beyond the utmost bounds of ocean, beyond the foundation of the sky. They are, then, spirits of some kind, not men alive or dead, demons of strange power who will do mischief, bring disease and famine; it is best to drive them away. Why, I have asked, did the Santa Cruz people shoot at Bishop Patteson's party in 1864, when certainly no white visitors had as yet given them cause for revenge? Because, it was answered, the elder men said that these strange beings would bring nothing but harm; and as to shooting at them, they were not men, and the arrows could not do them much harm. It is sad to think how correct too often the judgment of the old men has been proved to be.

II. In going through, however briefly, the history of these discoveries we are met with difficulties and doubts about names. It would be tedious to go through these Melanesian Islands with their names; but it will be interesting, I think, to consider them a little. (1.) It is interesting to observe how the geographical names tell of the nation of the discoverers and of the feelings with which the discoveries were made. The Spaniard is remembered in Guadalcanar, San Cristoval, Santa Cruz, Santa Maria, Espiritu Santo, which are marked with his language and his religion. When Bligh named the Banks' Islands, there was partly the matter-of-fact reference to shape—Sugarloaf Island, Saddle Island; partly the personal memorial of Sir Joseph Banks and himself. Cook, in the same way, gave his English names, recalling Britain in his New Hebrides and New Caledonia; commemorating friends and patrons in Sandwich, Shepherd Islands; and with great good sense keeping native names wherever he ascertained them, Api, Tanna, Eromanga, Malikolo, Anaiteum. The French names have been hardly used; a few remain, but many have passed into English—Star Island, Aurora, Pentecost. (2.) Orthography is, of course, in native names difficult; such are hard to ascertain in their right application, hard to catch in their true sound, hard to express in our letters. It is a very rare thing, I think, for an Englishman to get the right name at first; there is no security till a native writes down the word himself; and after that but very few will pronounce it right. When the name is one given by Europeans it is a

simple rule to write it in the language to which it belongs, Contrariété, Espiritu Santo, San Cristoval. (3.) There is much philological interest, of course, in the examination of native names, and with that ethnological and historical. Has the Solomon Island Bauro any connection with the Bouro of the Malay Archipelago? Is not the Futúna of the New Hebrides named after the Futuna of Horne's Island? Are not the names of the largest islands in the Fiji and Banks' groups identical, Vanua Lava and Venua Levu? If such questions can be answered, we learn certainly a good deal about the origin and mutual relation of the inhabitants. But another point of identity is much more important; I mean the practice, universal in Melanesia and in Madagascar, of combining the preposition meaning "at" with the name of a place, in Anaiteum equally with Antanánarívo.

III. To the voyager in these Melanesian Islands who has no special geological learning, the generally volcanic character of them is very apparent. He may think that the lofty island of Guadalcanar, rising to 8000 feet, or the high mountains of Espiritu Santo or New Caledonia, may have some other origin, but he cannot miss the volcanoes vigorously active, or still throwing out clouds of steam; and he can hardly help observing that many islands have the shape of those that are still active, or look like ruins of volcanic mountains in various stages of decay. He will be ready, therefore, to believe that very much is volcanic which does not clearly appear to be so.

There are four active volcanoes among the islands of which I am speaking:—Yazur, on Tanna, Lopevi, Ambrym, and Tinakula, near Santa Cruz. That at Tanna is comparatively well known, and has often been visited, being not lofty, and easily accessible.

The vast cone of Lopevi rises to an apparent point 5000 ft. above the sea. When I first saw it in 1863 I was told that it had never been seen by Europeans to show any signs of activity; but in the same year I saw it smoke, and it has since thrown out burning ashes.

Tinakula, as it is called, though the native name of it is Tamami, is again a perfectly-formed cone, rising to a height of 3000 ft. It has of late years been exceedingly active, throwing out glowing masses of lava which roll down into the sea. When Mendana was forming his settlement at Santa Cruz, nearly 300 years ago, the point of the cone was blown off.

The huge volcano of Ambrym has no cone visible, but apparently an enormous crater which, from the size of the mass of smoke that ascends from it, may be two or three miles across. It occupies the middle of the island at a height of 2500 ft., the centre of vast rugged fields of lava hitherto unapproachable. Round the circumference of the main mass of the volcano there rise recent cones no longer active, covered with forest from their peaks down the beautiful curves in which they sink to the sea. I know no scene in Melanesia more lovely than that which is viewed from Rodd's Anchorage under one of the largest of these lateral mountains, where the awful desolation of the main volcano is out of sight. There is no volcano in Melanesia that can compare with Ambrym.

It requires a much closer acquaintance with the islands than I possess to know in how many places in these islands volcanic action is yet alive. When Mendana discovered Savo the volcano was active. Some years ago I gathered there, that about fifty years before that a considerable eruption had taken place, and the natives were expecting another. There is a steaming vent, and a hot stream runs down: the Florida people say they hear rumblings from Savo and see smoke. I know of nothing else now active in the Solomon Islands.

In the Banks' Islands Vanua Lava is always steaming from its sulphur springs. Great lateral cones have been thrown up on the N. and E. sides, now quite extinct, but the streams which rise in the central mass run warm and stinking to the sea, and powder the rocks with sulphur. In the neighbouring island of Santa Maria there are steaming vents on the ridge which marks, I suppose, the edge of the ancient crater, now a lake, and on the hill Garat, that has been thrown up within it. There is also a group of hot pools, sulphurous jets, and basins of boiling mud within the encircling ridge: from which hot streams pour down to the lake beneath.

Bligh Island, Ureparapara, is a remarkable example of the type of Amsterdam or St. Paul's Island in the South Indian Ocean. The sea enters the ancient crater, the ridge of which rises to nearly 2000 ft.; and on the slope of that the volcanic heat still finds a vent.

Meralava, Star Island, is a massive cone abruptly rising from the sea to a height of 3000 ft., so steep that it surprises one that it should be inhabited. From below, the cone appears to terminate in a cup with a broken lip. Some years ago a native lad from a neighbouring island told me that he, with a companion, had mounted to this ancient crater. They found within it a bare plain, with a lake of black water, covered with a thick, dark cloud. A heavy darkness filled the place, a huge bird soared round their heads; awe and horror fell upon them, and they turned and fled. In the year 1884, however, Bishop Selwyn and Mr. Palmer of the Melanesian Mission ascended and explored the crater, and found that a comparatively recent cone had been thrown up within it. This was no doubt active when Quiros discovered this island, and found it to be a volcano, of which, probably, he had seen the light in the night-time, since he named it Nuestra Señora de la Luz. There is now no memory of an eruption, or any appearance of activity.

In the New Hebrides the volcanic action has not yet exhausted itself on Lepers' Island, but I know no other island there in the same condition.

All these volcanic islands, whether still in active operation, or now fuming out their latent fires, or long ago extinct, have dead and living coral round their bases: in most, I suppose, the island lies a ruined mass; old cones fallen to pieces, heaps of matter ages ago thrown up, lateral cones perhaps keeping much or something of their form; all now covered from shore to summit with forest growth. Such islands appear throughout. Some of them, I understand, are of immense antiquity, some are recent. I think it probable that they may be roughly classified according to the use in them of stone or shell implements, of chert or obsidian. But all alike have coral forming a certain proportion of their mass, the

rock of coral formation varying according to its age. In most cases I suppose a skilled observer could easily determine how the coral rock lies, and what proportion the core of volcanic rock bears to that which has formed upon it. When an island has had one or more steady periods of upheaval, elevated terraces of coral appear, as in Futuna and the Loyalty Islands; in Florida there is a cliff face white as chalk. The figure of Mota in the Banks' group tells its own story. There is the primary cone, with its shoulder of later discharges; the coral that had grown upon its base to a certain depth below low tide has been brought into view in one steady period of upheaval. Ashore, on the raised surface, are blocks of volcanic stones, and ravines cut deep through the ancient coral by torrents from the mountains above, show the species, such as madrepore, of which it is composed; on the beach, water-worn fragments of both coral and volcanic rocks lie among the living coral. In the Torres Islands, terraces formed by successive upheavals are conspicuous; but here there is no appearance of the volcanic core. At least in one of them, the natives dig for the volcanic stone that will bear heat for their ovens. Whether the land in these islands generally is now in course of elevation, I cannot say, but in the Banks' group it is; there is a patch between Mota and Motalava which has become more shallow within my recollection.

I know not whether there are in this part of Melanesia what are properly called atolls. There are lagoon islands of very different character. The Reef Islands of Santa Cruz show flat patches of coral and sand resting on the reefs; in such an example as Nakapu the lagoon is two miles across and the island lies upon the edge. In the Matema group the very irregular loop of the reef carries on it several disconnected islets; of which two in close neighbourhood are inhabited very characteristically: Nifolole by a score or two of Melanesians with their own peculiar tongue, Fenualoa, as the name will show, by men of Polynesian language, and no doubt colonists from the Eastern Pacific. On the other hand Rowa, in the Banks' group, has a very irregular reef, five miles long, with four small islets on the bight, of which one is inhabited; but this is formed upon a jagged point of volcanic rock, to all appearance the fragment of the edge of a sunken crater.

Florida in the Solomon group is peculiar, and calls to mind the mainland of the Aru Islands as described in Mr. Wallace's *Malay Archipelago*, because it is divided into three parts by two channels.[1] I say that the island is divided into three parts, because, though the northernmost channel is pretty wide, there is one name, Nggela, by which the whole is called by the natives and their neighbours, and no native name for either of the parts by itself; and because on the spot the country and the people are one, though traders have begun to speak of the Floridas instead of Florida. I feel sure that this is the island to which Mendana gave the name of Florida; and to the Spaniards certainly, sailing by, it would appear as a single island. It is characterised by sharp ridges, on which, now as then, many of the villages are perched, and by great barren patches of coarse grass or reeds. There is at one place the

[1] Observe the separation of Mara-masiki from Mara-paina by a similar channel.

apparent fragment of a crater, and at another, as I have said, a white cliff the like of which I have seen nowhere else in Melanesia; but the ribs of the island are of limestone. In this a remarkable cavern, called the *suku*, has been explored by Bishop Selwyn.

I should mention a rare feature in the physical geography of these islands. I have spoken of the lake which occupies the middle of Santa Maria in the Banks' group, filling up, as may reasonably be supposed, the crater of the volcano which has formed the island. There is nothing that I have heard of in the Melanesian islands to compare with it; it is, I suppose, quite five miles long, the still steaming mountain Garat having been intruded into it. I was the first European to pass along its shore, and to visit the splendid waterfall by which it pours into the sea; and I may be allowed, therefore, to speak of it with interest. But one cannot but think that so large a body of fresh water will some day repay its first scientific investigator with curious forms of life. Its name, moreover, the *tas*, is identical with that of one of the great lakes of Madagascar, Itasy.[1]

There is a much smaller lake in Vanua Lava in the same group (which has been seen by Rev. J. Palmer of the Melanesian Mission), the waters of which are discharged by two fine cascades. Another in Lepers' Island has been visited by Rev. C. Bice. It cannot be very far across, and at the edge furthest from the shore is a volcanic vent, the home of the spirit who governs the island ghosts. Men will go up there and climb a tree at the nearer margin, and call to Nggalevu to show that he is there, and a column of steam will shoot up from the distant shore in answer.

Bishop Selwyn has in this last year visited Tikopia, and found there a remarkable lake separated from the sea by a bank and covered with large water-lilies.

IV. I may venture a few words on the natural history of Melanesia, so far as I know it. The great rarity of mammals will surprise no one at all acquainted with the Pacific. There are *rats* everywhere, that have probably accompanied the natives in their canoes, and *bats* and flying foxes in great numbers. *Pigs* were seen almost everywhere at the discovery of the islands: the very common name of them, *puaka*, in the Pacific, has been rather absurdly derived from the Spanish "puerco," still more absurdly from the English "porker." The most common Melanesian word connects them with the Malay Archipelago. *Dogs* also were not uncommon before the introduction of them by Europeans: a common

[1] The native story concerning this lake is well worth telling. Where the lake now is was once a great plain covered with forest. Qat, the legendary hero of the group, cut down one of the largest trees on this plain, and began to shape it into a canoe. His brothers laughed at him, asking how he could ever get his canoe down to the sea? He answered that they would see by-and-bye. When the canoe was finished Qat took into it his wife and his brothers, and collected the living creatures of the islands, even those so small as ants, and then shut all inside. A deluge of rain came down, the hollow plain became full of water, Qat's canoe tore out a way for itself into the sea by the channel through which the waters of the lake now pour in the great waterfall. There was an expectation of a future return of this canoe, and some years ago, when a small trading vessel was seen standing in for the waterfall, the old people cried out that Qat was come again. There is no doubt that this story was current before the people heard of Noah and his ark.

name of them, *kuri*, may as well be derived from "cur." An opossum or *cuscus* is the one indigenous quadruped, and its distribution is remarkable. It is common in the Solomon Islands, but does not reach to Santa Cruz. It is said to be present in Espiritu Santo alone of the New Hebrides, where Quiros reported that there were goats.

I have not the least belief in the existence of anthropoid apes. The natives generally in the islands, small and great, have stories about the men of the woods, *orang utan*; but they are fully believed, where there is anything of real belief, to be men. Whether these stories are founded on the fact of the existence of the orang utan or monkeys in the regions from whence the Melanesians came is another, and interesting, question.

The distribution of the white *cockatoo* is very curious. Abundant in the further Solomon Islands, they stop short at the two straits that separate respectively Guadalcanar and San Cristoval, Malanta and Ulawa. One would suppose that a few miles of sea would be no considerable obstacle to a bird, but so it is; the cuscus crosses both straits, and the cockatoo is left behind.

There is a remarkable bird that I believe is found in each of these groups—a megapod, a relative of the mound-building brush turkeys of Australia. Mr. Wallace describes these birds of more than one species as he saw them in Celebes and the Moluccas. I cannot say whether there be two species in Melanesia, but the habits of the bird are very different in different places. I am not aware that they make a mound anywhere. In the Banks' Islands and the New Hebrides they lay their eggs in the hollow of a decayed tree, or in a heap of rubbish that they have scratched together. These birds in the Banks' Islands are called *malau*, and the megapods studied by Mr. Wallace in Celebes are *maleo*, with by no means an accidental resemblance. He remarks that the difference in appearance between the sexes is so slight that it is not always possible to distinguish it without dissection. In Savo the natives boldly declare that there is no such distinction at all—that all are hens. At Savo, and also in some other islands, these birds come out of the bush to lay their eggs, and to look after them, twice a day as the natives say. It is a curious thing that at Savo these birds, without any attempt at domestication, become the property of individuals; that is to say, the sandy patch in which they burrow is divided off into distinct properties, the owners of which only have a right to the eggs.

Fowls, when I first knew the islands, were common, *i.e.* the native breed like game-fowl. They are now extinct in all the more commonly visited places, the introduced English birds having driven them away and destroyed them. They still, however, abound in Santa Cruz, where the Spanish discoverers observed them.

Crocodiles or alligators are abundant in the Solomon Islands and in Santa Cruz; they are known in the Torres Islands, Banks' Islands, and perhaps the Northern New Hebrides. At any rate their name is known, *i.e.* some form of *via* or *vua*, the Malay *buaya*, Malagasy *voay*. In Ysabel, at any rate, the natives declare that the crocodile has four eyes. These hideous reptiles have certain superstitions connected with them; they share with sharks the reputation of becoming the abode or the representatives of departed souls. *Snakes* are not very abundant, nor often

poisonous. It is singular that at Mota, in the Banks' Islands, there are no land snakes, and the natives declare that if brought there they will not live. There is a common and curious superstition about an amphibious snake that haunts the shores; it is believed to have the power of changing itself into the form of a young man or woman to tempt one of the opposite sex. I must mention the *eels* in the *tas*, the lake of Gaua, Santa Maria. They are immense. The natives dig pits at the edge of the lake when the water is low, into which the eels enter when it is high. When the water is again low they spear them. It is the custom in those parts to measure any remarkably large object with a bit of line or bark, breaking it off at the length, and to hang up the measure in the common hall. One of these was shown me, the girth of an eel not of the very largest size, but 30 inches round.

Frogs are abundant in the Solomon Islands, but do not come further towards the east. Lizards are abundant everywhere; are in some islands eaten, while some species are very much dreaded.

When Mendana settled for two months at Santa Cruz, and again when Quiros spent a month in the great bay of Espiritu Santo, both of them declare that there were no *mosquitos*. Such are abundant now. The discoverers were no doubt exaggerating the excellencies of the lands they had discovered, yet there must be some meaning in this. It is a singular thing that one name for the mosquito prevails from the Asiatic continent throughout to Fiji. Can it be that this torment of tropical life has been carried about from one source? I think not. But the Spanish discoverers may have meant by mosquito the small house-fly, which was certainly unknown in the Pacific till European intercourse introduced it. The odious blow-fly is too common, with generally the same name throughout Melanesia.

I cannot venture to say anything about the Flora, but I will mention two things which follow on the habits of the people: the areca palm, the nut of which is chewed with the betel leaf; and the pepper, the root of which makes the well-known *kava* drink. It is a remarkable thing that, as I believe, there is no place in Melanesia in which the use of both these narcotics prevails as a native custom. The use of the betel is universal in the Solomon Islands and Santa Cruz, and comes as far eastward as Tikopia. In the Banks' Islands, New Hebrides, and Fiji, it is unknown. The pepper, the betel, grows naturally in the New Hebrides; the areca, of which the nut is chewed with the betel, is, I believe, wherever it is used, exotic, and not indigenous; although there are various species of palms which, to the inexperienced, look the same. One may safely say that the palm, with the use of the nut, has been brought from the West, from the Asiatic side of the Pacific, and belongs to the connection of the Melanesian people with the race commonly called Malay. I do not myself believe in any intercourse in the way of commerce of the modern Malays with the people of the Solomon Islands, but the use of the betel has spread eastwards, as I said, to Tikopia. It would be a point of knowledge worth ascertaining how far westwards this way the use of the betel has spread, and whence it may be supposed to be derived. The use of *kava*, the infusion of the root of the *Piper methysticum* has no doubt come into Melanesia from the Eastern Pacific,

where, as is well known, the Polynesians are devoted to its use. It is certainly a new introduction into the Banks' Islands, in one at least of which it was quite a novelty within my recollection. The Tikopians are Polynesians, and do not use it, nor do the Polynesians of the Reef Islands of Santa Cruz, who have been settled in those islands for certainly more than 300 years, for Mendana found them there. Is, then, the use of kava one that has spread westwards into Melanesia within comparatively modern times? In Madagascar, so closely connected with Melanesia, I cannot learn that either the betel or the kava are used by the natives.

I think it is probable that most people are little aware with how much skill and care those whom we call savages carry on their cultivation in these regions in which unassisted nature might seem bountifully to provide for human wants. A native garden of yams diligently weeded and trained is a beautiful sight. Captain Cook saw, with surprise, in New Caledonia, works for irrigation, which is practised also where water abounds in the Banks' Islands and the New Hebrides. That these are ancient arts is shown by the use of the same word in the Malay Archipelago and in the New Hebrides for a dry garden as opposed to one which is irrigated. The cultivated varieties of fruit-trees and plants are very numerous. In the little island of Mota there are 80 varieties of cultivated yams recognised and named. How many well-known varieties of bananas have their own names I cannot tell; but a native knows them by the look of their stems and leaves.

I say nothing of the natives themselves, except this, that I believe there is a common underlying identity of race as of speech, which displays itself through the amazing multiplicity of languages and dialects, and the great diversity and admixture of the people. I believe that to talk of Malay influence either on the speech or the race is an anachronism; but two currents of influence are, I think, plainly traceable, on which float respectively the betel-nut and the kava root, one ancient, continual, broken in the direction of its course, from the Asiatic side; the other comparatively modern and direct from the Polynesian islands of the Eastern Pacific. The ethnology and philology of Melanesia is to be studied together with that of the whole ocean world which lies between Asia and America; but the most fruitful course of study will not be turned eastwards towards Polynesia, but westwards all along to Madagascar, though that be close to Africa itself.

DR. LIVINGSTONE AND LAKE BANGWEOLO.

(With Maps.)

By E. G. Ravenstein, F.R.G.S.

The map of the Bangweolo, first given to the world after Dr. Livingstone's death, differs so widely from the representations given of that lake on the more recent maps, that it is well worth while to inquire into the reason of this, quite apart from the fact, that anything connected with Livingstone's work in Africa is sure to enlist the sympathy of the geographical public.

I have generally found Livingstone so wonderfully correct in his geographical delineations, bearing in mind the scant resources in the matter of instruments, that I should be loth to reject his work, simply because the ground which he was the first to explore has since his death been gone over by another explorer, and this all the more, as the account published by Lieutenant Victor Giraud leaves very much to be desired on the score of accuracy. Lieutenant Giraud is, however, borne out on several points by Messrs. Capello and Ivens, who came within seven geographical miles of the lowest point he reached on the Luapula, and whose latitudes and longitudes present a remarkable agreement with the observations of the French explorer. They prove conclusively that the Luapula issues from the south-western angle of the lake, a fact which had indeed become obvious to me after reading James Wainwright's diary of the march from Chitambo, where Livingstone died, around the western shore of the lake, and was indicated on my Map of Eastern Equatorial Africa, published in 1881. Of far greater importance is the shifting of all places around the lake to the eastward. Kazembe's river, which on Dr. Livingstone's map illustrating his *Last Journals* stands in long. 28° 35′ E., now occupies 29° 5′; whilst Mpabala, an island in the lake visited by Livingstone, has been shifted from 28° 57′ E. to 29° 50′ E., a difference of nearly a degree. Far more striking still is the difference in the shape of the lake, which now measures scarcely thirty miles across from east to west, whilst on Dr. Livingstone's map we see an open expanse of water exceeding 120 miles in a longitudinal direction.

It shall now be my task to point out these various discrepancies in detail, and to reconcile and combine Livingstone's work, as far as possible, with that of his successors. In performing this duty I have had the advantage of consulting Dr. Livingstone's original maps, kindly placed at my service by the great traveller's daughter, Mrs. Bruce, and that this has not been without advantage will be seen on an examination of the map which I have the pleasure of placing before you. I may state here that the large map prepared by my friend Mr. Bolton for the *Last Journals* is, in the main, a reproduction of the maps sent home by Dr. Livingstone, who was an excellent draughtsman. This applies also to the delineation of Dr. Livingstone's route to the eastern shore of the lake, and beyond Matipa's Island as far as the Lukulu River. It is obvious that if Dr. Livingstone had lived to complete his task, he would have produced a map of the lake very much superior to the one which I am able to place before you. As samples of Dr. Livingstone's cartography I append to this paper two reproductions of his manuscripts. The first of these is a general map of Lake Bangweolo and its vicinity, prepared after his first visit to the lake, and consequently in a large measure based upon native information. The second specimen illustrates the curious manner in which the Doctor plotted his routes in the rough. On examining this sketch, which contains all the names of the original, although much reduced in scale, it will be seen that the route down the Lipoposhi is shown twice, namely, as following the left bank of the river, and then, as it were reflected in a looking-glass, on the opposite bank. That such a sketch would puzzle a draughtsman intrusted with preparing a clean copy is obvious, and it accounts for the fact that on the preliminary map

of the journey across Africa many rivers were shown flowing to the north, which on a later map took the opposite direction. This fact, so easily explained now, produced an explosion of wrath on the part of that excellent though severe critic, the late Mr. Desborough Cooley.

I shall now proceed to consider Dr. Livingstone's routes in detail. Dr. Livingstone visited Lake Bangweolo twice. On June 9, 1868, he started from Kazembe's town, reaching Mapuni on the lake shore on the 19th, and Masantu's village the day after. After some delay he embarked on July 25th in a fine canoe, 45 feet long, and late in the evening was landed near the northern extremity of Mpabala. Returning to Masantu, he left for the north on July 30th. This section of Dr. Livingstone's route calls for little comment. If Mpabala is shown by him as a small island, whilst Lieutenant Giraud, who had better opportunities of examining it, represents it as an extended peninsula, this can matter but little in a region where land and water are blended, and it is difficult to tell where the water ends and the land begins. At all events, the general disposition of the islands in this portion of the lake is described in similar terms by both explorers.

Far greater difficulties have to be surmounted in combining Dr. Livingstone's more easterly route with that of Lieutenant Giraud. Along this route Dr. Livingstone determined four latitudes (Luongo River, 10° 6′54″; Lofu, 10° 31′ 20″; Matipa, 11° 11′; and Munikazi, 11° 38′11″), but of these latitudes we were able to accept only one, viz., that of Matipa,[1] unless, indeed, we had been prepared to shift the lake shore far to the eastward, thus compensating for smaller latitudinal by greater longitudinal differences. Matipa thus lies S. 10° E. of Chunga on our map, whilst on Dr. Livingstone's map it bears S. 50° E. In other words, we should have been compelled to reject Lieutenant Giraud's work altogether. This, however, we were not prepared to do. Lieutenant Giraud travelled from Moamba's, the position of which is approximately known, to Zapaira's in ten days, that is at the rate of six geographical miles daily; thence to the lake, upon which he launched his boat on July 8th, and spent four days. He crossed the lake to Chiribe, having the position of Matipa pointed out to him, and, passing on to the western side of the lake, he connected Chiribe with Mpabala and Kizi, that is, with two localities visited by Dr. Livingstone in 1868. It appears to us that this boat-voyage satisfactorily settled the relative positions of various islands and a considerable portion of the shore of the lake. We have not, therefore, hesitated in placing Matipa in the position assigned to it by Lieutenant Giraud (retaining, however, Dr. Livingstone's latitude), and our task is thus limited to adjusting Dr. Livingstone's route to the new position of Matipa, and in doing this we have been compelled to reject in a large measure the delineation of that route as given from the explorer's own maps in *Last Journals*, that delineation being altogether irreconcilable with the narrative.

Dr. Livingstone crossed the Kalengwesi on December 21st, and

[1] On Livingstone's map the latitudes of the Lofu and of Matipa are retained. On January 22d, he observes (*Last Journals*, ii. p. 267):—"No astronomical observations worth naming during December and January; impossible to take any, owing to clouds and rain."

arrived at Chungu's town on January 9th. Plotted, as far as possible from the *Journals*, I make the distance 43 miles, whilst on Dr. Livingstone's map it is 54 miles, the direction in both being approximately the same. Curiously enough the distance travelled between the Luongo and Chungu's would have been almost exactly the same as that adopted by me had I accepted Dr. Livingstone's observed latitudes. In that case, however, the distance from Chungu to Matipa would have been reduced to 43 miles, which is obviously short of the truth.

On January 12th, Dr. Livingstone made a start for the lake, but the guides furnished him by Chungu led him astray, and he consequently turned back, and followed the Liposhosi upwards as far as the bridge above Chungu, which he crossed on January 19th in search of a more easterly route. On the same day, as we see from his diary, he observed the latitude at the head of the Lofu, and I have not therefore hesitated to reduce the 20 miles of the original map to 7, and this all the rather as several "sponges" had to be crossed. On January 21st we find Dr. Livingstone at Chitunkubwe's; on the 25th he crossed the Lofu by a large bridge, and after a laborious journey over spongy soil, and across numerous streams, he arrived on the 29th at the edge of a "buga" or prairie, whence he resolved to send out scouts to discover a route to the lake. One of these scouts returned on the following day, having reached the lake after a march of eight hours, and seen two islands. The other scout only came back on February 1st. He had been stopped by a large river flowing into the lake (evidently the Luena), but had not encountered a single human being.

Dr. Livingstone then resolved to return to Chitunkubwe's, where he arrived, following his old route, on February 5th, having accomplished, as he supposed, 41 miles in fifteen hours. This distance I have been compelled to reduce to 18 miles (as the crow flies), whilst on Dr. Livingstone's own map it amounts to 23.

Chitunkubwe proving more amiable than expected, Dr. Livingstone was able to start once more on the 8th. On the 10th he camped at the bridge over the Lofu;[1] on the 11th at the Kachabwe (the day's journey having been accomplished in three hours, as compared with five or six during the first attempt at reaching the lake); on the 12th he crossed the Kasoso and the Mokisya (said to flow to the NW., but shown on the map to take a south-easterly course), and then the Mofungwe; on the 13th he travelled four hours—first E., then SE., and finally S., and came within sight of the Luena (at a locality called Kametese, on one of the MS. maps).

From this point Dr. Livingstone sent men to Matipa's for boats, and they returned in the evening of the 15th, attended by some hunters, but without the desired boats. Now, unless we are mistaken in identifying Dr. Livingstone's Chirubi or Chiribe with Lieutenant Giraud's Kirwe ("island"), such a journey is altogether impossible if we accept the delineation of the lake as given on the map in *Last Journals*, for the distance from the Luena mouth to Chiribe amounts there to over 80 miles.

[1] *Last Journals*, vol. ii. p. 274; for "miwale," read Nkwale, for "Methonua" read Melomtiya. Methonua stands for *Methonica gloriosa*, a plant which grows along the banks of this river.

On our map the distance from where Livingstone stayed to Chiribe is 35 miles, and we therefore think that Dr. Livingstone's scouts cannot have got as far as Chiribe, but must have picked up their hunters at some other island. On the 16th, Dr. Livingstone sent out another party of scouts, and when these, too, returned unsuccessfully, he had himself carried (on the 19th) to the hunters' canoe, three miles distant, and, embarking it on the Luena, he descended in a westerly direction for three hours, landing at an old village of Matipa's. Here the mouth of the Luena could be seen. This river is very deep, and flows through a flooded plain or "buga," covered with rushes, ferns, papyrus, and lotus, only the few "islands" rising above the general level being covered with palms and other trees. One of these islands (Malandangao) lies at the mouth of the river.

On February 22d, Susi and Chuma were despatched to Matipa's, and they returned on the 26th with the much-needed boats. Dr. Livingstone embarked on March 1, and, crossing the flooded prairie, reached Motovinza island, inhabited by fishermen, on the same day. On the 2d they paddled for seven and a half hours (at the rate of three miles an hour) to another island, with a populous "boma" (stockade); and on the 4th he at length reached Matipa's Musumbo, where on the 15th of March 1873 he addressed his last despatch to Lord Granville.

Having sent his people in advance, Dr. Livingstone himself started on March 24th, in a boat, punting for six hours over a flooded "grassy" sea to an islet; on the 25th, five hours' of similar locomotion brought him to Kasenga's village; on the 26th, still punting, he reached Kabinga's, south of the Chambeze, here 1200 feet wide, 18 feet deep, and with a current of two miles an hour.

After considerable delay, Dr. Livingstone was able to leave Kabinga's on April 5th, himself and the "luggage in canoes, and the men on land." The journey was continued in this manner until the 9th, when Dr. Livingstone found himself at a ford over the Muanakazi, where his land party had crossed, and the latitude of which he determined to 11° 38′ 11″ S., notwithstanding the severe indisposition under which he laboured, and which detained him until the 12th, on which day he arrived at Chinama. Exceedingly weak from the loss of blood, he allowed himself to be carried by his men. As he proceeded onward, his days' journeys became shorter and shorter, until, between the 18th and the 29th, on which day he arrived at Chitambo's, they did not exceed $1\frac{3}{4}$ hours daily. By this time, the life of the great explorer was rapidly ebbing away. On the 27th, the last day on which he made an entry in his note-book, he described himself as "knocked up quite." The day after his arrival at Chitambo's, he asked for the distance to the Luapula; and early on the following morning, that is on the first of May, he was found kneeling by the side of his couch—dead.[1]

There remains now to say a few words on the homeward march of

1 Jacob Wainwright and Majwara both declare that Dr. Livingstone died on May 4: Majwara says, moreover, that Chitambo refused permission to stay; and that Livingstone was carried *back* three hours' march towards Kabende, where, after *several* days' illness he died on May 4 (*Proc. R.G.S.* xviii., 1874, p. 245). Kabende (Kavende) lies, however, to the *west* of Chitambo's.

Livingstone's servants. The Rev. H. Waller, editor of the *Last Journals*, has derived his information from Susi and Chuma, two of Dr. Livingstone's servants, but the diary kept by Jacob Wainwright,[1] the only member of the party who could write, is far more complete and trustworthy. As to the place where the party crossed the Luapula, we learn from Lieut. Giraud that this was done at Msiri's, a chief not mentioned by Wainwright, but evidently a close neighbour or successor of Kasara Marama. The French traveller was also told that Chitambo lay two days' journey to the south-east, which fairly agrees with J. Wainwright's statement, as, although Dr. Livingstone's servants spent five days on the journey, the distance only amounts to 32 miles.[2] Having crossed the Luapula the party skirted the western shore of the Bangweolo, crossed Dr. Livingstone's track of 1868, and joined his last route at Kapesha's. The distance, as measured on our map, amounts to 168 miles, and as twenty-four days were spent on the journey, the daily progress averaged 7 miles.

We have indicated on our map the directions which Gamitto took during his journey to Kazembe and back. The Portuguese crossed the Chambeze at some distance from the lake, where it is confined within steep banks, 48 feet in height (this was on July 18, 1832, the dry season). Further north they came upon the Ruena (Luene).

Kakomwe and his successor Kabungo occupied a locality near Livingstone's Chitunkubwe. Crossing the Luenque or Loango, Gamitto passed over a hill range (Shirunguta) to the residence of the Moena Mpanda, who occupied a different site then from that where Dr. Livingstone found him. Between Mpanda and the Kazembe the rivers Luena and Mombereze (Mbereze) had to be crossed.

I append to this paper a list of astronomical positions, etc., derived from Dr. Livingstone's note-books. Only a few of these have found a place in the *Last Journals*. I have also computed Dr. Livingstone's aneroid observations, which yield concordant results. The altitude of the Nayssa, according to my computations, is about 1600 feet, which very nearly agrees with the result based upon two years' barometrical observations at Livingstonia. Bangweolo lies at an altitude of 4000 feet (4250 feet according to Lieut. Giraud), and Moero Okata has an altitude of 3100 feet (3790 feet according to Lieut. Giraud). Accepting Dr. Livingstone's figures, the fall of the Luapula, from lake to lake, amounts to 900 feet, being at the rate of nearly 5 feet a mile.

It is very much to be desired that the mass of meteorological and other information still buried in Dr. Livingstone's diaries should be exhumed. The longitudes and latitudes have never been re-computed, as was promised and expected. How sad it is that explorers should spend their lives upon the prosecution of their work, only to find the results of their labours cast aside by those intrusted with their publication! This remark applies to Livingstone no less than to many other men who have done similar work.

[1] Petermann's *Mittheilungen*, 1874.

[2] According to Capello and Ivens' inquiries, Chitambo, in their time, lived much further to the south, namely, on the Upper Lohombo, a tributary of the Luapula.

ASTRONOMICAL AND HYPSOMETRICAL OBSERVATIONS MADE BY DR. DAVID LIVINGSTONE, 1866-1873.

The Latitudes and Longitudes are given as computed by Dr. Livingstone.
The Altitudes have been computed by me.
Figures and names in square brackets are interpolations.

Reference to "Last Journals."	Date.	Locality.	S. Lat	E. Long.	Altitude in Feet.	Var. of Compass.
	1866		° ′ ″	′ ″		° ′
I. 14	March 27	Pemba, Mikindany Bay, .	10 8 23	...	...	...
17	April 8	Nyangedi, . . .	10 13 20	...	...	...
18	,, 10	Narri, ...	10 23 14	...	...	...
27	,, 27	Narri, on Ruvuma, . .	10 54 40	...	...	...
28	,, 29	Nachuchu (nearly due N. of Nangadi lake, . .	10 58 28	...	2	...
36	May 8	Iponde (vill. opposite granitic Nakapuri Rocks), .	..	..	230	...
38	,, 12	Vill. 4′ ENE. of Nyamato island, or Matawatawa Rapids, . . .	[11 13]	...	320	...
42	,, 20	Loendi, near Ngomano, .	..	...	190	...
42	,, 21	Near Ngomano, on the Loendi, 2′ S. of the confluence, . . .	11 26 23	37 49 52?	360	...
47	June 7	Makochera's (2′ S. of Rovuma, . . .	11 22 49	...	...	...
48	,, 9	Njeñgo Hill, . . .	11 20 5	..	...	...
48	,, 10	Ngozo Hills, . . .	11 18 10	...	...	...
57	,, 23	Chirikaloma's vill. (on Rovuma), . . .	11 37 44	...	...	...
62	,, 27	Chingawala's vill. (on Rovuma), . . .	11 40 51	...	...	...
66	July 1	Mtarika's (on Rovuma), .	11 36 5	...	...	...
69	,, 5, 6	Mtende's vill., . . .	...	36 16?	1380	...
69	,, 7	Lemile Camp, . . .	11 52 10	...	...	...
70	,, 8	Lemata (Linata) mountain, near, ...	12 0 20	...	...	...
77	,, 18	Pamoembe [Mwembe], Mataka's, . . .	12 53 0	35 29 15	3360	...
86	,, 30	Pezimba's, . . .	...	35 24?	3870	...
88	Aug. 3	Mbanga, *a* . . .	13 21 35	...	4300	...
92	,, 11	Misinje, confluence with lake, ...	13 32 55	34 44?	1600	14 20 W.
93	,, 21, 24	Loangwa, . . .	13 25 24	35 3 15?	1720	13 30 W.
96	Sept. 5	Ngombo Promontory (1′ W. of its base, at its N. edge, and due S. of Misinje confluence), .	13 39 53	...	...	...
96	,, 6	Palilole or Panthunde, 10′ or 12′ E. from preceding station [Makanjira's], .	13 42 54	...	...	...
96	,, 7	Pansangwa lakelet, . .	13 49 9	...	...	...
97	,, 9	Kandango's, shore of lake,	13 57 49	...	...	...
98	,, 10	Chefu's, ...	14 5 9	...	...	...
98	,, 12	Pantoza Pangone, . .	14 15 30	...	...	...

a "Took lunars" *Last Journals*, p. 88.

Reference to "Last Journals."	Date.	Locality.	S. Lat.	E. Long.	Altitude in Feet.	Var. of Compass.
	1866		° ′ ″	° ′ ″		° ′
113	Sept. 24	Near Marenga's (2′ E. [W.] of Mt. Namisa), . .	14 13 9	. .	. .	...
116	Oct. 4	Kiemasusa's (Kimsusa's), or Katosa's, . .	...	35 40 15	...	...
123	,, 7, 8	Mpatapala, top of Kirk's range, 4′ W. of Katosa's,	.	.	4220	14 W.
129	,, 13	Kauma's, . .	14 24 39	...	...	...
131	,, 16	Chipanga's, . . .	14 33 36	.	...	...
132	,, 17	Theresa's, . . .	14 32 20	...	4440	...
134	,, 19-21	Paritala (Chitokola's vill.),	14 21 49	33 50?	4253	...
138	,, 26	Molua or Pamalua (Chuma's), . . .	14 6 21	...	4040	...
142	Nov. 1	Kangene's vill., near Kongwe [Irongwe?] mt.,	14 8 38	33 22 13	3970	13 W.
145	,. 12	Chabuela's, on Mando River, ...	13 56 26	...	3790	...
148	,, 19	Kanyindula, in Kanyenjere Valley, . . .	13 48 51	.	.	...
149	,, 20	Bua, source of the, . .	13 40 0	. .	. .	...
152	,, 24	Zeoro's, on Lokuzhwa R.,	13 23 7	...	...	...
153	,, 27	Mpande's, . . .	13 17 35	32 29	4030	...
154	,, 30	Chilunda (Mboro's vill.), on Lokuzhwa River, .	13 11 10	...	...	...
156	Dec. 8	Mparawe, hill and vill., .	12 58 29	...	2230	...
158	,, 14	Maranda's, left bank of Loangwa, *b* . . .	[12 45 0]	...	...	...
159	,, 16	Loangwa, right bank, .	12 40 48	...	...	...
160	,. 17	Pamazi, left bank, . .	12 37 40	...	...	...
161	,. 19	Kazembe's vill. (18′ W. of Loangwa), . . .	...	...	1980	...
163	,, 24	Kavimba's (60′ W. of Loangwa), . . .	12 12 0	...	2330	13 W.
	1867					
169	Jan. 4	Chitembo's, . . .	...	...	3750 *c*	...
172	,, 11	Chafunga's, *d* . . .	...	...	5330	...
173, 175	,, 15	Chitane's (Mpini), . .	11 9 2	31 58 52	5300 *e*	...
174	,, 17	Lisunga (Chaokila's), near Lobo River, . . .	10 53 13	32 1 ? ?	4650	...
183	,, 28	Chambeze, ...	10 34 31	...	...	...
185) 189 > 254)	Jan. 31) Feb. 3, 6, 7, 8)	Chitapangwa Lobemba (Molemba's vill.), . .	10 14 6	31 46 45	4270 *f*	...
196	,, 22	Merungu River, near Moamba's, . . .	10 9 15	...	4410	...
197	,, 26	Moamba's, on Merenge River, ...	...		4330	...
200	March 8	Loombe River, . .	90 46 35	...	...	...
200	,, 12	Loendawe, . . .	...		5160	...
201	,, 13	Chibe's, on Lokwene R., .	9 34 30	32 5	5000	...
203	,, 24	Kazonso's, on River Kazembe, ...	9 9 20	32 0 ?	...	...
204	April 3	Pambete (Liembe), [Tanganyika], . . .	8 46 40	31 57 *g*	2800 *h*	...

b Crossed Loangwa. *c* Dr. Livingstone's own computation.

d Entry on January 8:—"As the rates are unfortunately altered, and C. has a very large losing rate, I touch the regulator in hopes that the change may improve it. It has felt the injury much, and so has B."—(D. L.)

e According to Livingstone, the altitude of Mpini (Chitane's) is 5353 feet by aneroid, and the mountain rises 1285 feet above it.

f 4700 feet by B.P. and bar., according to Dr. L.'s own computation.

g According to Sir Th. Maclear, 31° 21′. *h* Altitude (B.P.) from *Last Journals*, p. 204.

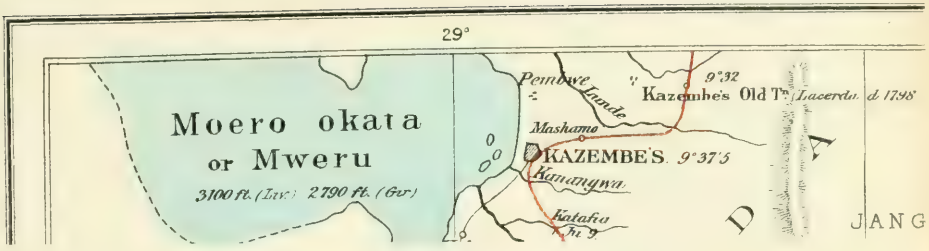
Reference to "Last Journals."	Date.	Locality.	S. Lat.	E. Long.	Altitude in Feet.	Var. of Compass.
	1867		° ′ ″	° ′ ″		
I. 209	May 14	Karambo, on Lofu, near confluence with Liemba [Tanganyika], *h* . .	8 16 18	31 18 0	...	...
221 / 257	May 23 to / Aug. 28	Chitimba's, on Chiloa R.,	8 57 56	30 19 30?	4380	...
229	Sept. 2	Chongu's vill., on Lofu, ford,	8 55 34	29 57 0	...	...
229	,, 10, / 14, 19	Hara, 6 hours W. of Lofu, *i*	8 55 1	29 27 30??	...	15° W.
235	Oct. 8	Karungu's, on Kamosenga River, in Lopere, . .	8 13 43	28 31 ? ?	3280	14° W.
238	Oct. 30	Chifupa's, on Choma R., .	8 28 13	...	...	...
242	Nov. 3	Muabo, in Kabuire, . .	8 26 18	. .	[3350]*k*	...
242	,, 8	Lake Moero, near N. end,	8 40 0	..	...	...
245	,, 19	River Chungu, near Kazembe's old town, .	...	...	3290 *l*	...
250	,, 25	Kazembe's Town, 7′ S. of southern end of Moero, .	9 37 26	...	...	...
250	Dec. 2	Kazembe's Town, . .	...	28 6 45??	3140	14° W.
	1868					
269	Jan. 4	Kalongozi River, . .	9 4 1	...	3280	...
270	,, 12	Karembwe's, near Lake Moero, ...	8 51 1	...	...	...
272	,, 17	Kabwabwata [Kabwakwa],	8 28 17	...	3350	...
272	Feb. 14	Do.,				
283	March 21	Mpweto's, on Lualaba, .	8 23 57	...	...	...
283	,, 30	Kabwabwata, ...	8 28 20	...	...	...
288	April 17	Lake Moero, ...	8 36 45	...	...	...
291	,, 25	Kifurwa, rivulet, great bend, ...	9 10 45	...	...	...
292	,, 30	Mandapata, rivulet, . .	9 27 25	...	...	...
293	May 4	Chungu, right bank, 1′ N. of Kazembe's old town, .	9 31 40	...	...	...
293	,, 6, 7, 28	Kazembe's town, . .	9 38 0	...	...	...
300	,, 31	Kanengwa rivulet, S. end of Mofue, ...	9 39 55	...	...	...
352	Nov. 28	Chifupa's, . . .	8 27 25	.	...	...
	1869					
Vol. II.	June 8	Ujiji, ...	4 54 45	...	...	...
		Nyangwe, Lualaba, . .	4 10 0	...	...	...
19	July 20	Kasenge (Tanganyika), .	5 43 58	...	...	...
		Ujiji (*ib.*), ...	4 55 2	...	...	...
21	Aug. 12	Miketo's (Mekheto), in Rua, ...	5 47 13	..	...	...
22	,, 19	Lobumba River, right bank,	5 26 20	...	...	...
22	,, 20	Mokeko's vill., Lobumba River, 4 hours below preceding, . . ,	5 20 50	...	...	...
22	,, 21	Mokwaniwa, confluence of Zambezi and Lobumba,	5 9 13	...	...	...
23	Sept. 12	Pyanamosinde, 2′ E. of Mount Moloni, . .	4 54 41	...	...	...
26, 28	,, 26	Moene Kus's Town [Mugambwa], *m* . . .	4 39 41	...	...	...

h This is identical with Pamlilo's village, which is far N. of the Lofu mouth.—(E. G. R.)
i "B. gets worse. C. loses 20′ 2″ daily, B. over 40″."—(D. L.)
k Livingstone's own computation. (*Last Journals*, i. p. 242.)
l 3350 feet. (Dr. Livingstone's own computation.)
m Mount Kinyima, 2′ NNW. of it, near right bank of Lombonda, a tributary of Loela.—(D. L.

Reference to "Last Journals."	Date.	Locality.	S. Lat.	E. Long.	Altitude in Feet.	Var. of Compass.
	1869		° ′ ″	° ′ ″		
II. 35	Nov. 9	Muana Balange's, . .	14 47 21	...	...	...
	,, 21	R. Luamo, 8′ or 10′ above confluence with Lualaba [Kirumba's], . .	4 39 7	...	...	...
	1870					
43	April 5	Mamohela, Manyuema, .	4 15 6	...	...	...
	1871					
106	March 9	Kasongo's, 5′ E. of Lualaba (in Kabondo country), ...	4 27 53	...	...	...
159	Mar. 28 / July 20	Nyangwe, on Lualaba, .	4 9 20	...	...	...
159	Nov. 30	Lusizi River, mouth of, Tanganyika, . .	3 18 34	...	...	...
	1872					
162	Jan. 2	Mount Kibanga, or Burimbe [Urimba], near, .	5 54 29	...	...	...
165	,, 19	Mpokwa vill. [Utanda], .	6 18 41	...	...	..
236	Oct. 15	Mokaria, Tanganyika, .	7 0 14	...	...	..
240	,, 19	Kilando district, Nkoma islet, ...	7 8 23	...	...	...
242	,, 28	Kitanda islet, . . .	7 52 25	..	...	.
243	Nov. 4	Luazi River, near confluence with Mbita, and 2′ E. of lake, . . .	8 17 19	...	...	...
249	,, 23	Kampamba's, on River Muanwani, a tributary of the Kapondosi, . .	9 0 24	...	...	...
250	,, 24	Kasonso's successor, on river Molulwe, . .	9 4 29	...	...	...
293	Dec. 5	R. Malunda, or Lampusi,.	9 33 0	...	...	...
260	,, 29	Luongo River, . . .	10 6 54	...	...	...
	1873					
266	Jan. 19	South Lofu, or Lovu of Chambeze, . . .	10 31 20(??)	...	...	...
283	March 3, 4, 5,	Matipa's islet, Mosumba, .	11 11 0	31 3 0	4052	...
288	,, 21	Matipa's, all wrong, .	...	...	...	...
291	,, 31	R. Chambeze, left bank, camp, ...	...	...	...	...
291	April 2	Near confluence of Chambeze, ...	..	29 36 30??	...	...
291	,, 3	Chambeze, near confluence with lake, . . .	...	29 27 0	...	...
294	,, 10	R. Munikazi (Monekaze),	11 38 11	...	...	...
297	,, 20	R. Moenda, . . .	...	...	4030	...

LAKE BA

BY E. G. RAV



LAKE BANGWEOLO.

BY E. G. RAVENSTEIN, F.R.G.S.

DR LIVINGSTONE'S MAPS.

COPIED FROM HIS MSS

ON THE EARTHQUAKE SHOCKS EXPERIENCED IN THE EDINBURGH DISTRICT ON FRIDAY, JANUARY 18, 1889.

By Ralph Richardson, F.R.S.E.,

Vice-President of the Edinburgh Geological Society.

(*A.*)—PREVIOUS EARTHQUAKES IN DISTRICT.

It may be interesting to notice briefly the previous earthquake shocks experienced in the Edinburgh district, before referring to those felt last month.[1] I shall state them in chronological order, premising, however, that I cannot believe that the list is complete.

1608.—Earthquake at 9 P.M. on 8th November 1608, experienced at St. Andrews, Cupar, Edinburgh, Glasgow, and Dundee, but particularly at Dunfermline.[2]

1789.—About 3 o'clock P.M., on 30th September 1789, two or three distinct shocks were felt at the mansion-house of Parson's Green, London Road, Edinburgh. All in the house were alarmed. The house seemed to receive two or three violent blows in the foundation, so that all the furniture shook.[3]

1801.—About 6 A.M., on 7th September 1801, a smart shock was distinctly felt in Edinburgh, Leith, and vicinity. It was preceded by a rumbling, rushing, hollow noise, and it lasted two or three seconds. Beds, tables, chairs, etc., shook violently in some houses, the shaking resembling the rocking of a cradle.[4] This earthquake of 1801 is remarkable as being possibly the cause of death of two women shearers, who were crushed to death by the gable of a barn (to the west of Edinburgh) falling in on the morning of 7th September. A large tenement in Paterson's Court, Edinburgh, also sank so considerably that morning that the inhabitants were warned out by the authorities. Curiously, the shock appears to have been felt only in the New Town, and not in the Old Town or south side. Houses seemed lifted up gently, and then violently shaken in a direction from north to south.[5] This earthquake of 1801 resembled that of 1889 in several respects—1st, Both barometer and thermometer were high; 2d, There were two shocks, one about 4 A.M. and the other about 6 A.M., the former being not so strong, and consequently not so much felt as the latter. The earthquake of 1801 was, however, experienced over a wider area than that of 1889, embracing Glasgow, Fife, Perthshire, and particularly Comrie and vicinity, where the shocks were very severe, and were accompanied with loud subterranean noise.[6]

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[1] This paper was read before the Edinburgh Geological Society on 21st February 1889.

[2] Calderwood's *History of the Kirk of Scotland* (Wodrow Society, Edinburgh, 1845).

[3] *Edinburgh Fugitive Pieces*, collected and published by William Creech, Edinburgh, 1791.

[4] *Edinburgh Magazine*, September 1801.

[5] *Scots Magazine* for 1801, p. 656.

[6] Rev. Samuel Gilfillan in *Edinburgh Magazine* of September 1801.

1847 or 1848.—A shock felt in Edinburgh which, in one house, overturned a tumbler full of water.[1]

1886.—On 8th April 1886, at 12.20, a slight shock was felt at Gorebridge, Mid-Lothian. The miners in Lord Lothian's pits at Newbattle were alarmed by loud explosions and vibration of the strata. In the villages of Cowdengrange and Newtongrange the shock was also felt, houses oscillating, and crockery falling.[2]

1888.—On Thursday, 2d February 1888, an "alarming earthquake was experienced throughout a great part of Scotland."[3] At Morningside, Edinburgh, a slight shock was felt about 5 A.M., which rocked a bed and made the house tremble and furniture rattle. At Old Dalkeith Road, Edinburgh, a man felt at 5.2 A.M. his bed rock as if he was in a ship. In the *Scotsman* of 2d February (the very day the earthquake occurred) appeared a "warning to colliers," stating that the barometer was rising quickly, and that an anticyclone was approaching, with meteorological conditions which rendered coal-dust highly inflammable and which were very favourable to the accumulation and sudden appearance of gas. This earthquake also resembled that of 1889 in some particulars—1st, a colliery warning was issued at the same time as the earthquake of 1888, whilst a terrible colliery explosion occurred at Hyde, Cheshire, on the same morning as the earthquake of 1889; 2d, a total eclipse of the moon preceded the earthquake of 1888 just as a partial eclipse preceded that of 1889. The total eclipse occurred four days before the earthquake.

(*B.*)—EARTHQUAKE OF 18TH JANUARY 1889.

1. *Localities affected by first shock.*—The earthquake of 1889, like that of 1801, had two shocks, one several hours before the other. On 18th January last a shock was felt at six different localities in the Edinburgh district during midnight. The localities are Bellsquarry, two miles west of West Calder; Penicuik; Magdala Place; Charlotte Square; Canaan Lane, Morningside; and Napier Road, Merchiston. The hour of the shock is variously stated at about 2 A.M., about 4 A.M. or about 5 A.M. This variety in stating the hour indicates, in my opinion, not a succession of shocks, but merely uncertainty in fixing the time of the first shock, owing to its occurrence at midnight, when most were in bed and in darkness.

2. *Localities affected by second shock.*—The second shock had a much wider range of observers, no fewer than seventy-two localities being recorded as affected by it. I have prepared a list of these localities (appended to this paper) which may be divided into

(*A*) Western District (Linlithgow, Currie, etc.).
(*B*) Southern Do. (Peebles, Penicuik, etc.).
(*C*) Suburban Do. (Colinton, Corstorphine, etc.).

[1] Letter to *Scotsman*, 21st January 1889.

[2] *Nature*, 29th April 1886, p. 611.

[3] *Scotsman*, 3d February 1888. This earthquake is also described (with a map) by Mr. Charles A. Stevenson, C.E., in *Proceedings of the Royal Society of Edinburgh*, vol. xv. p. 259.

(*D*) City District (*a*) West End; (*b*) North Side; (*c*) Leith, Trinity, etc.; (*d*) South Side; (*e*) Central.

(*E*) Burntisland.

3. *Details of second shock.*—These details accompany the localities given in the appended list. Some details are curious. Thus, whilst the shock stopped the clock of Currie parish church, it set a-going a clock belonging to the schoolmaster of Ratho parish which was standing still. Two details of importance were arrived at by the earthquake's interference with these clocks. 1st. Assuming the parish church clock was exact, its stoppage would show the precise moment of the earthquake. The clock stopped at 6.53 A.M., and about this time is generally given for the shock elsewhere. 2d. The schoolmaster's clock had a pendulum motor, so that he fairly inferred that the direction in which the pendulum was moved was the direction in which the earth-wave proceeded. That direction was east to west or *vice versâ*. The second shock consisted occasionally of several tremors. One observer felt her bed tilted up twice or thrice. The shock lasted for several seconds. It had the same indications as in India or South America, as attested by observers who had been there. It was accompanied by a noise described differently by different observers. A heavy train passing, a large tree falling, a cart or carriage passing, a heavy weight falling, or a distant explosion, are all similes used to describe the noise heard. Then whilst some observers seem to have been rocked in their beds, others felt their beds quietly moved along as if on castors, and others were violently aroused from sleep, and one boy was actually thrown out of bed. In every case furniture moved, crockery rattled, and houses shook. The aspect of the sea previous to the earthquake was striking. Fishermen sailing to Newhaven noticed that the water appeared discoloured. A relative of my own, formerly resident at Coquimbo on the coast of Chile (where earthquakes are common), once remarked that the approach of an earthquake could be recognised by the water becoming discoloured.

4. *Hour when second shock occurred.*—I have said that Currie parish church clock stopped at 6.53 A.M. This very time is given by observers in Leith, Newington, and Balerno; whilst 6.54 is given by those in Wardie and Trinity; and 6.55 by those at Harperrig (5 miles south-east of West Calder) and Peebles. The general statement of the time of occurrence of the second shock is a few minutes before 7 A.M., and the shock was probably almost instantaneous over the whole area.

5. *Direction of earth-ware in second shock.*—This is very variously given by observers, as the following table will prove :—

From W. to E., or *vice versâ*,	Six localities, viz.—Harperrig, Ratho, (where the pendulum was started), Trinity, Scotland Street, Newington, and Morningside.
From S. to N., or *vice versâ*,	Five localities, viz.—Davidson's Mains, Dean Bridge, Wardie, Pilrig, and Burntisland.
From SE. to NW., or *vice versâ*,	Two localities, viz.—Magdala Place and Leith.
From NE. to SW.,	One locality, viz.—Barony Street.

6. *Meteorological conditions.*—Professor Falb, of Leipzic, proceeding

doubtless upon meteorological data, prophesied that shocks of earthquake would be felt in the south of Europe on 18th January, the day of our Edinburgh one.[1] An earthquake on the same day occurred at Leghorn, two distinct shocks being felt, one at 6.20 P.M., and the other at 9.40 P.M.,[2] so that Professor Falb's prophecy came true. In regard to meteorological conditions, I have pointed out that previous earthquakes in the Edinburgh district presented some features resembling that of 1889. For example :—

1*st.* In 1801 and 1889, both the barometer and thermometer were high when the shocks occurred. When the second shock occurred in 1889, the barometer at the time registered 29.964 inches. The thermometer varied from 47° minimum to 55° maximum for the twelve hours preceding 9 A.M. on 18th January.[3] The early morning of 18th January was windy, and at 9 A.M. it blew west-south-west gusty. The evening of 17th January was beautiful, clear, and mild, as those will remember who, like myself, walked home from the last meeting of our Society on 17th January. The exceptional mildness of the season was remarked everywhere.

2*d.* In 1888 and 1889, collieries were affected at the same time as the earthquakes. The meteorological conditions which produce accumulations of gas in mines seem favourable for the production of earthquakes. A colliery warning accompanied the earthquake of 1888. A disastrous colliery explosion occurred at Hyde, Cheshire, shortly after 9 A.M. on 18th January last, or about two hours after the earthquake at Edinburgh.[4]

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[1] On 1st November 1755 occurred the disastrous earthquake at Lisbon. Shocks were likewise felt the same day at Gibraltar, Sardinia, Holstein, etc. In Scotland, on the same day, between 9 and 11 A.M., the water of Lochs Lomond, Katrine, and Ness, was much agitated. The water of Loch Lomond suddenly rose 2½ feet, and then sank very low, rising and falling again for hours. The agitation of Loch Ness was so violent as to threaten destruction to some houses built on the loch side. The earthquake at Lisbon began about 9 A.M., and the shocks continued for ten hours.—(*Scots Magazine,* December 1755, p. 593).

[2] *Scotsman*, 23d January 1889.

[3] Meteorological Register of Leith Navigation School. *Scotsman,* 19th January 1889.

[4] The following is the Meteorological Report on the period from 17th to 18th January, which appeared in *Scotsman* of 4th February 1889 :—"The large high-pressure system which had persistently held over Russia since the commencement of the month now showed some signs of moving southwards ; but on the morning of the 17th (January 1889) a new anticyclone appeared over the Bay of Biscay ; and in the course of the following twenty-four hours the two areas of high readings coalesced and formed a long band stretching right across France and Central Europe. This change in the distribution of pressure was accompanied by the advance of two large and deep depressions, the first of which appeared off the north-west of Norway on the morning of the 18th, while the second advanced in a more southerly track to the neighbourhood of the Hebrides. The progress of the Norwegian depression was attended by strong south-westerly gales in Scandinavia, while the easterly movement of the Scottish disturbance was accompanied on the afternoon of the 18th by a severe westerly gale in the Shetland Islands and Caithness. The south-westerly current of air which set in as the two low-pressure systems advanced occasioned a considerable rise of temperature in all parts of the kingdom, and on the 18th some very high readings were observed, especially in Scotland and the northern districts of England and Ireland. At Nairn, Leith, and Dublin, the thermometer rose to 56 degs., and at Wick, Lairg, and Ochtertyre to 57 degs., while at Aberdeen it reached a maximum of 58 degs., these values being from 12 to 16 degs. above the average for January."

3d. In 1888 and 1889, eclipses of the moon preceded the earthquake. A very fine total eclipse of the moon (well seen at Edinburgh) occurred on the night of 28th and morning of 29th January 1888. The earthquake occurred four days afterwards. Again, a partial eclipse of the moon (visible at Edinburgh) occurred on 17th January, between 2 and 9 A.M. The earthquake occurred next day.

(*C.*)—GEOLOGICAL FEATURES OF DISTRICT.

An "eminent geologist" furnished anonymously the following note to the *Scotsman* of 19th January 1889 :—

"Geologically, nothing definite can yet be said as to the origin of the earthquake. The Water of Leith valley is a valley of erosion, and there is nothing either in the character of the rocks or in their geological structure to throw any light upon it. There is plenty of evidence of rock dislocations and igneous phenomena of various kinds in Edinburgh and its neighbourhood, but all these date back to a remote geological period of antiquity. So far, therefore, nothing in the meantime at least can be gathered as to the source of the occurrence. In connection with this later shock, however, this fact, which has up to this time escaped notice, may be mentioned. Shortly before the New Year an earthquake of some severity occurred on the Borders. The shock, which affected a portion of the Cheviot Hills, was distinctly felt in the district through which the Oxnam Water flows, and is described as a vibration accompanied by the grating or grinding sound which accompanies earth movements."

I do not know who contributed this note, but I agree in thinking that Geology does not yet furnish us with a key to the earthquakes of the Edinburgh district. The recent earthquake, as I have shown, was by no means confined to the Water of Leith valley, but embraced a circle extending from Linlithgow to Burntisland, southwards by Portobello to Eskbank and Peebles, and north-westwards to Harperrig and West Calder. Throughout all this wide area sedimentary and volcanic rocks abound. Trapdykes, faults, and fractures are extremely common. No district has been more subject to igneous action and stratigraphical dislocations in the distant past, but there is nothing to throw light upon the origin of earthquakes or direction of earth-waves in this district at the present day. I have mentioned how variously observers stated the apparent direction of the second shock this year. Six said it was from W. to E. or *vice versâ*, whilst five said it was from S. to N. or *vice versâ*. Now, if any one supposed that the direction of trapdykes was likely to furnish him with some clue to the probable direction of earth-waves, he would find himself in as great a difficulty as ever. Trapdykes in the Edinburgh district run in every direction, sometimes E. and W. and sometimes N. and S. Out of 17 trapdykes, figured on the Geological Survey's Map of the district, embracing the city and suburbs of Edinburgh, 10 run N. and S. and 7 run E. and W. This map was published in 1859. Ten years later, our Society's former Treasurer, the late Mr. George Lyon, a good local geologist, in a paper which he read before us in April 1869, instanced 19

trapdykes in the city of Edinburgh. "Their general average direction," he remarked, "bears north-west and south-east, and across the strike of the strata. . . . The evidence goes to show that these dykes generally run parallel to each other, and are connected, it may be, with lines of fault."[1] Ten years later, in 1879, Mr. John Henderson published in our *Transactions*[2] his Map of the Igneous rocks within the city of Edinburgh. It shows 30 trapdykes, or 11 more than Mr. Lyon. Of these 30 dykes, 18 bear north-west and south-east, whilst 8 bear north-east and south-west, 3 are nearly north and south, and 1 east and west. So that Mr. Henderson's map corroborates Mr. Lyon's conclusion that the general direction of the city trapdykes is north-west and south-east.

Turning to our record of the second earthquake shock on 18th January, we find that at only two localities (Magdala Place and Leith) did the earth-wave seem to travel from SE. to NW. or *vice versâ*, so that the direction of our trapdykes is no indication of the direction of the seismic current. Certainly we must regret the paucity of observations regarding the apparent direction of the earth-waves on 18th January. Out of 72 localities affected by the second shock, we have only 14 returns as to the direction of the earth-wave. Observers noted the shock, the oscillation, the rattling of furniture, and the sound accompanying the earthquake, and they also somewhat vaguely indicated the time of its occurrence, but few noted the apparent direction of the earth-wave which shook their houses or rocked their beds.

In closing this paper, I must refer to another body of evidence which, I regret, is entirely wanting in connection with the recent earthquake. We have no statement of the nature of the foundations of the houses shaken. Were they founded on solid rock or on travelled material? An interesting and curious investigation is opened by this question. On 28th November 1880 an earthquake was felt in Scotland and Ireland, its eastern boundary passing Inverness, Blair Atholl, Callander, and Motherwell. In describing it Mr. Charles A. Stevenson remarked, "The stations where the noise was heard were, for the most part, situated on hard dense rocks, with little or no soil near them."[3] Again, on 28th July 1883, a very destructive earthquake convulsed the island of Ischia. Dr. Johnston Lavis of Naples, in describing it, says: "One remarkable fact is the manner in which the houses of the marinas have suffered much less than others in their immediate neighbourhood, or even farther away from the seismic vertical. This is no doubt due to their foundation reposing on sea-sand, which from the looseness of its particles, and therefore inelastic nature, acted as a mattress and absorbed the earth-waves. The same fact is observable in all buildings that have their foundations of the loose alluvial tufas and ash of the plains and valley bottoms, whereas the destruction of houses built on the rock was terrible, thus reversing the well-known parable."[4]

[1] *Transactions*, vol. i. p. 325. See also his paper in vol. ii. p. 203.
[2] *Ibid.* vol. iii. p. 222.
[3] *Proceedings Royal Society of Edinburgh*, vol. xi. p. 186.
[4] *Nature*, 6th September 1883.

LIST OF LOCALITIES affected by the Earthquake Shocks in the Edinburgh District on Friday, 18th January 1889, with hours stated and details given by observers.

Localities grouped as follows:—

First Shock.—General.
Second Shock:—
(*A.*) Western District. (Linlithgow, Currie, etc.)
(*B.*) Southern District. (Peebles, Penicuik, etc.)
(*C.*) Suburban District. (Colinton, Corstorphine, etc.)
(*D.*) City District.
(*a.*) West End.
(*b.*) North Side.
(*c.*) Leith, Trinity, etc.
(*d.*) South Side.
(*e.*) Central.
(*E.*) Burntisland.

FIRST SHOCK, *Friday, 18th January* 1889.

Hour.[1]	Place.	Observer.	Details.
A. M.			
5.	Bellsquarry, 2 miles east of West Calder.	A lady.	A slight shock.[2]
4.58.	Penicuik.	Superintendent Wright, Mid-Lothian Constabulary.	Distinct shock felt in at least two places in the village. Sound resembling distant thunder. A bed perceptibly vibrated.[3]
About 3 (also stated as between 3 and 4).	Do.	Not stated.	Shock felt by residents in southern portion of village.[2]
Midnight.	Magdala Place, Edinburgh.	A lady.	Shock felt.
About 2.	Charlotte Square, Edinburgh.	Not stated.	Slight shock experienced.[2]
About 4.	Canaan Lane, Morningside, Edinburgh.	Do.	Lady heard rumbling sound as of thunder, and experienced slight tremor.[4]
About 2.	Napier Road, Merchiston, Edinburgh.	Mr. J. M. Fleming.	Felt slight shock, which, from his experience of earthquakes in India, he thought indicated an earthquake.

[1] The variety of hours stated is believed to indicate not a succession of shocks, but uncertainty in fixing the time of the first shock owing to its occurrence at midnight.—R. R.

[2] *Scotsman*, 19th January 1889.

[3] *Scottish Leader*, 19th January 1889.

[4] Letter in *Scotsman*, 21st January 1889.

Second Shock, *Friday, 18th January* 1889.

(*A.*) Western District.

Hour.	Place.	Observer.	Details.
A.M.			
A few minutes before 7.	Linlithgow.	Not stated.	Beds seemed raised an inch from below. Rumbling sound heard.
...	Hartwood House, near West Calder.	Mr. Walker.	Bed shook as if a castor had broken.
...	On Railway near West Calder.	Signalman.	Felt railway vibrate as if a heavy train passed.
A little before 7.	Bellsquarry, 2 miles east of West Calder.	Kitchen (a workman).	Bed shook and chest of drawers quivered.
Do.	Do.	A Lady.	Shock shook house and rattled tins on walls.
6.50.	Causewayend, 4 miles SE. of West Calder.	A workman.	House shaken and dishes on table rattled.
...	Cairns Castle, 5 miles SE. of West Calder.	Not stated.	Shock felt.
6.55.	Harperrig, 5 miles SE. of West Calder.	Mr. James Gray.	Was moved in his chair from west to east. Everything in room oscillated like a pendulum. Sound like distant time-gun twice.
...	House of Muir, 3 miles west of Balerno.	...	Shock felt.
A few minutes before 7.	Kirknewton.	...	Bedroom furniture and ware shaken. Tremor lasted three seconds.
...	Goodtrees, 1 mile west of Balerno.	...	The flagstones in dairy moved up and down.
...	Cockburn, do.	Mrs. Pennycook.	Noise as if a large tree had fallen. A lamp was overturned.
...	Dean Park farm near Balerno.	Mr. Love.	Shock felt.
6.53.	New Mills near Balerno.	Mr. Robertson.	Chair on which he sat was moved twice. Lamp nearly thrown over. Tray on shelf rattled. He rushed outside.
...	Balerno.	Villagers.	In several houses windows, doors, and crockery rattled. The duration of shock was about 3 seconds. In one house a lamp was tilted over and a girl awakened.
...	Ravelrig Siding, 1 mile NW. of Balerno.	Signalman.	Felt his signal-box tremble.
6.53.	Currie.	Not stated.	Parish church clock stopped at this hour. Houses shook, and a rumbling noise was heard.
...	Do.	Railway signalman.	Felt his signal-box quiver and his chair move beneath him.

Second Shock.—*continued.*

(*A.*) Western District.

Hour.	Place.	Observer.	Details.
A.M.			
...	Blinkbonny, near Currie.	Railway signalman.	Brick house considerably shaken.
Shortly before 7.	Juniper Green.	Councillor Murray.	Person sleeping on a spring mattress nearly thrown on floor.
...	Do.	Mr. A. G. Laing.	Was awakened by a violent shock, which caused bed to vibrate, and toilet-ware to rattle.
...	Curriehill.	Railway porter.	Recognised shock and noise from earthquake experience abroad.
About 7.	Ratho.	Rev. Mr. Bisset, parish minister.	Bed shook twice.
...	Do.	Mr. Hislop, schoolmaster.	Sharp shock, with noise of a heavy traction-engine. The shock started a clock which was standing still. The shock was apparently from east to west, or *vice versa*, as the clock's pendulum was moved in that direction.
...	Hatton Mains, 1 mile S. of Ratho.	...	Shock felt.
About 7.	Gogarmount, 1½ miles NE. of Ratho.	Mr. Blackwood, publisher.	Wash-hand basin and ware rattled. A large wardrobe was tilted. A boy was thrown out of bed, and thought that some one below the bed had done it. Several persons felt their beds quietly moved along as if on castors.

(*B.*) Southern District.

6.55.	Peebles.	Dr. Clement B. Gunn.	A patient said her bed was tilted up twice or thrice. Others heard rumbling sound like a heavy cart.
6.50.	Eddleston Manse, Peebles-shire.	Rev. A. J. Murray.	His daughter's bed swayed for several seconds, door shook, and rumbling sound like a passing carriage was heard.
6.52.	Penicuik.	Not stated.	Houses shook, chairs and tables moved, and crockery rattled. Shock lasted about 2 seconds. Sound like the gunpowder explosion which occurred near Penicuik sixteen years ago. Previous to shock there was a lull in the gale. A workman who had been in India recognised shock, and was rocked backwards and forwards seated on a large lump of alkali.
Do.	Do.	Correspondent of *Scottish Leader*.	Gentle rocking felt over district. Two tremors immediately after each other.
...	Do., Valleyfield Paper Mill.	Not stated.	Shock felt amid din of machinery.
About 7.	Eskbank.	Not stated.	Severe shock. Beds rocked.

Second Shock.—*continued.*

(*C.*) Suburban District.

Hour.	Place.	Observer.	Details.
A.M.			
...	Colinton.	Not stated.	Shock felt.
About 7.	Slateford.	Do.	Oscillation felt.
6.55.	Gorgie.	Do.	Shock felt. About 9 A.M. a portion of ceiling of Gorgie boot factory fell.
...	Craigs near Corstorphine.	Do.	Shock felt.
...	Broomhouse, do.	Do.	Do.
A few minutes before 7.	Corstorphine.	Do.	Beds were shaken. A lady seated on a chair felt it move. Sound as if of a distant explosion, or a door violently closed. An unusually warm wind blew from SW.
About 7.	Corstorphine Hill (southern slope).	Mr. Octavius Pelly, Ardanteallia.	Sharp shock shaking the whole of the furniture in bedroom, including a heavy wardrobe. From Indian experience, recognised it as an earthquake.
...	Davidson's Mains.	Not stated.	Shock felt by person in bed, who said the bed oscillated from south to north. Shock did not last longer than a second.
.	Portobello.	Beadle of St. Mark's Episcopal Church.	On entering the church on 18th January at 9 A.M., he discovered that a portion of the ceiling (10 × 6 yards) had fallen since the previous afternoon.

(*D.*) City District.

(*a*) *West End.*

About 7.	Dean Park House.	Principal Sir Wm. Muir.	Sudden shock. House trembled and beds swayed. Crockery shook. Same indications as in India. His son from India thought it a bad shock. Dogs barked.
Do.	Dean Bridge cab office.	Mr. Stewart.	His brother from Valparaiso recognised earthquake. A bed shook for a few seconds in a lateral direction from north to south or *vice versa*.
6.50.	Belgrave Crescent.	Not stated.	Bed moved and dressing-glass shook.
6.55.	Buckingham Terrace.	Do.	House shook for two seconds. Sound as of two heavy weights dropped.
...	Ravelston Place, Dean.	Mr. G. W. W. Barclay.	Same indications as in India. A slight but unmistakable shock.
6.45.	Magdala Place.	A lady.	Bed oscillated laterally from south-east to north-west. Rings on dressing-table drawers rattled. Sound as if heavy weight dropped in adjoining room. Dog did not awake.
...	Do.	Do.	Shock violently tilted beds and awakened sleepers. Pictures hanging on wall were moved to one side. Dog did not awake.

Second Shock.—*continued.*

(*D.*) City District. (*a*) *West End.—continued.*

Hour.	Place.	Observer.	Details.
A.M.			
...	Magdala Place.	Hon. Fran. J. Moncreiff.	Bed seemed jerked up from below, as if some one was under it.
...	Magdala Crescent.	...	Beds violently shaken.
...	Coates Gardens.	.	Beds shaken.
About 7.	Charlotte Square.	...	Sharp shock. Bedroom ware and fire-irons rattled. Bed shaken.
...	Chester Street.	...	Portion of ceiling fell.
		(*b.*) *North Side.*	
Before 7.	Eildon Street, Inverleith Row.	Mr. John Kinmont, S.S.C.	Bed oscillated slightly and window rattled. Tremor felt by three other persons.
6.30	Inverleith Ter.	Not stated.	Shock lasted a fraction of a minute. A friend from India recognised earthquake.
...	Bellevue Place.	Do.	Shock felt.
6.52	Scotland Street.	Do.	Two shocks followed each other almost instantaneously. Beds were shaken, also glass and windows. Wave moved in an easterly direction.
. .	London Street.	Mr. T. A. Croal.	Sensation like sea-sickness.
...	Barony Street.	J. Edington Aitken.	Bed oscillated from north-east to south-west.
Before 7.	Pitt Street.	...	Sound as of heavy weight falling.
...	Inverleith Row.	Medical Gentleman.	Sound resembled lorries passing.
		(*c.*) *Leith, Trinity, etc.*	
6.54.	Wardie Road.	..	Bed shook laterally for nearly two seconds. Oscillation distinctly north and south.
6.54.	Trinity (Lixmount and Granton Villa).	. .	Two gentlemen made independently a careful note of the *time* of the shock, and agreed that it occurred at six minutes to seven.
..	Trinity.	...	Person felt himself gently rocked from east to west, or *vice versa*.
6.53.	Leith (Morton Street).	Mr. George Redpath, observer of the Scottish Meteorological Society.	Whilst seated, was moved forward for nearly three seconds towards the north-west. The barometer at the time registered 29·964 inches, and was falling steadily. The temperature was high and rising quickly. On perceiving the shock he immediately turned round and noted the time by a clock in the sitting-room. He found it was 53 minutes 15 seconds past six. On going to verify it by an astronomical clock in another room, he found, to his regret, he would have to allow a margin of about 10 seconds earlier or later. There was only one oscillation felt.

Second Shock.—*continued.*

(*D.*) City District. (*c*) *Leith, Trinity, etc.—continued.*

Hour.	Place.	Observer.	Details.
A.M.			
...	Cambridge Gardens, Pilrig.	...	A bed lying east and west oscillated for an instant. Soon afterwards there was another shaking of the house. Dog growled when door creaked.
...	Spring Gardens.	Bailie Cranston.	Felt shock.

(*d*) *South Side.*

Shortly before 7.	Canaan Lane, Morningside.	...	Beds trembled and ware rattled. Western gable shook to its foundation.
Do.	Shandon Road, N. Merchiston.	Mr. W. Veitch.	Bed seemed violently jerked off floor laterally.
...	Fountainhall Road, Grange.	Mr. J. A. Robertson.	Room and bed shook. Crockery rattled.
6.53.	Newington.	Not stated.	Shock felt. Bed swayed from west to east.
About 7.	2 South Oxford Street.	Do.	Sound like fall of a heavy weight on floor, followed by a vibratory motion and sound, accompanied by a sudden jerk and oscillation.
About 6.50.	Morningside.	Mr. A. Clarke.	Bed oscillated from west to east.
...	Craigmillar Park, Newington.	Blind Asylum inmates.	Felt shock.
...	Lauder Road, Grange.	Councillor Miller.	Do.
...	George Square.	Mr. W. Skinner.	Do.

(*e*) *Central.*

...	Princes Street.	Mr. Sturrock, hairdresser.	Found busts in shop moved round.
...	York Place.	...	Shock felt.

(*E.*) Burntisland.

...	Burntisland.	Mr. J. Parlane.	Houses shook as when a door is violently shut. People rose to examine the doors and find whether they had been suddenly closed. The houses shook from north to south, which Mr. Parlane thinks shows that the earth-wave moved from south to north.

Note.—*The accompanying Map of the district shows all the above localities, and will enable the extent of the Earthquake area and several details to be seen at a glance.*—R. R.

MAP ILLUSTRATING
THE EARTHQUAKE SHOCKS
EXPERIENCED IN THE
EDINBURGH DISTRICT
ON FRIDAY 15th JANUARY 1869
Illustrating a Paper by Ralph Richardson F.R.S.E.
Scale of Miles
Part of PERTH
FIRTH of FORTH
EDINBURGH
Portobello
Musselburgh
Dalkeith
Penicuik
Colinton
Corstorphine
Cramond
Queensferry
Linlithgow
Kirkliston
Ratho
Currie
Balerno
Slateford
Gogar
Corstorphine Hill
Craiglockhart Hill
Blackford Hill
Braid Hills
Arthur's Seat
Salisbury Crags
Calton Hill
Leith
Granton
Trinity
Newhaven
Portobello
Duddingston
Craigmillar
Liberton
Morningside
Colinton
Slateford
Gogar
Ratho
Kirkliston
Cramond
Queensferry
Musselburgh
Dalkeith
Penicuik
Roslin
Lasswade
Loanhead
Bonnyrigg
Gilmerton
Swanston
Fairmilehead
Oxgangs
Comiston
Morningside
Bruntsfield
Meadowbank
Portobello
Joppa
Duddingston
Craigmillar
Liberton
Gilmerton
Swanston
Fairmilehead
Oxgangs
Comiston
Bruntsfield
Meadowbank
Joppa
Roslin
Lasswade
Loanhead
Bonnyrigg
Trinity
Newhaven
Granton
Leith
Calton Hill
Salisbury Crags
Arthur's Seat
Blackford Hill
Craiglockhart Hill
Corstorphine Hill
Braid Hills
Pentland Hills
Moorfoot Hills
Lammermuir Hills
Firth of Forth
Firth of Tay
Inverkeithing
Dunfermline
Kinross
Perth
Scale of colouring according to Altitude
FIRST SHOCK
SECOND SHOCK
The Arrows indicate the direction which the second Earthquake Wave seemed to have
signifies a Trapdyke as indicated on
Ordnance Survey Map of District 1859

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

An Ordinary Meeting of the Society was held in Dowell's Hall, Edinburgh, on Thursday, 7th February, when Dr. Codrington read the Paper which we publish this month as our first article. Dr. George Smith, C.I.E., presided.

Dr. Codrington had previously, on Tuesday, 5th February, read his Paper on the *Islands of Melanesia* at a Joint Meeting of the Glasgow Branch of the Society and the Philosophical Society of Glasgow, in the Hall of the latter Society, when Mr. Renny Watson presided, and moved the vote of thanks to the lecturer.

GEOGRAPHICAL NOTES.

EUROPE.

Paris Geographical International Congress.—We are requested to give publicity to the following further arrangements by the Organising Committee of the Congress. The Congress will be held between the 5th and 11th of August 1889, in the rooms of the Paris Geographical Society, 184 Boulevard Saint-Germain; but one meeting will be held in the Trocadéro. Negotiations have been opened with the French railways to secure an abatement of charges to members of the Congress.[1] It has been decided to reduce the Sections of the Congress to the following six aspects of the science of geography, namely:—(1) Mathematical, (2) Physical, (3) Economical, (4) Historical, (5) Scholastic, and (6) Explorations and Voyages. Members wishing to take part in the deliberations of the Congress are requested to send in due notice of any communications they propose to present. As already stated, each Geographical Society taking part in the Congress has been requested to furnish a report, "for the region which they represent," on the explorations and publications which have most advanced geographical science during the present century. This report will consist of two sections:—(1) An account of the explorations carried out by men of the same nationality as that of the representative Society, and (2) a corresponding bibliography of the principal geographical publications. These reports will subsequently be collaborated by a special commission, and published as a "monument of the history of Geography during the nineteenth century."

The Colonial Empire of France.—The colonies of France, not including the Congo Territory, cover an area of 772,232 square miles, and contain a population of 22 millions. These are the official numbers, based on the most recent statistics. The colonies which export the largest quantity of merchandise to France are Martinique and Guadeloupe. Each of these islands sends goods to the value of 17 million francs (£680,000) yearly, consisting principally of sugar, cocoa, log-wood, spirits, and preserved fruits. India sends coffee, pistachios, pepper, tamarinds, woven goods and skins, worth 16 millions (£640,000); Saint Pierre and Miquelon, cod and cod-liver oil to the value of 15 millions (£600,000). Birds, feathers, gum, ground-nuts and fruits, valued at 14 millions (£560,000), come from the Senegal; sugar and vanilla, of the value of 10 millions (£400,000)

[1] See *S.G.M.* vol. iv. p. 484.

from Réunion; Guiana produces 5 million francs (£200,000) worth of gold, feathers, and cocoa. The imports from the remaining colonies amount together to 8 millions (£320,000). Thus the colonies send to France yearly goods to the value of over 4 million pounds sterling. Algeria and Tunis are not included in this estimate. Besides this, the colonies sell goods to foreigners to the value of 127 millions of francs (£5,080,000.) The total value of the colonial exports and imports is 474 millions (£18,960,000) — *Le Mouvement Géographique*, Nov. 4, 1888.

ASIA.

The Configuration of Central Asia.—The mountain systems of Asia, unlike those of any other continent, consist of a central plateau, from which several mountain ranges diverge. This plateau is divided into two parts, which should rather be called two independent plateaux, the eastern embracing Tibet and the desert of Gobi, the western being the plateau of Iran (Persia). The latter, at a few points only, attains the height of 4000 feet, and occupies only 7,000,000 square miles, whereas the former rises to the height of 4000 to 10,000 feet, and covers an area of about 17,000,000 square miles. The two systems extend from the Black Sea and Persian Gulf to the Sea of Japan, a distance of more than 5500 miles. The breadth of the system in the east from Yunnan to Manchuria is 1800 to 2000 miles, while in the west, between the hills of Carmania and Gedrosia in Persia and the steep slopes leading down to the plains of Bokhara, it is less than 700 miles. The two plateaux form a continuous elevation, but they diminish considerably at their junction. At this point lofty mountain masses arise, from which the Himalaya, Hindu-Kush, and Bolor chains diverge. The southern limits of these plateaux are parallel; the chain of the Himalaya, extending from the Gulf of Tong-king to Kabul, 2800 miles, runs parallel to that which runs from the mouth of the Indus to the Taurus in Lycia. This chain is also parallel to the northern boundary of the plateau of Iran, which extends to the Elburz Mountains at the south end of the Caspian Sea, and then traverses Azerbijan and Armenia. The skirting mountains of the eastern plateau, however, are by no means parallel; while the line of the Himalaya range is continued southwards by the ranges of Further India, until it terminates in the Malay peninsula; the most northern chains, the Baikal and Yablonoi Mountains, reach Tchukches and Behring Strait. The axis of this plateau runs from south-west to north-east, starting at the east of the sources of the Ganges, between Kashmir and Lingzi Thung on the one side, and Mt. Kailas and the sacred lake Mansarowar in Tibet, on the other. Thence it passes along the summits of the In-shan Mountains, beside the northern sweep of the Hoang-ho, and along the Khinghan Mountains to the northern bend of the Amûr. On the northern side of this axis lies the desert of Gobi, a long and wide valley extending east and west. The lowest part is Gobi Proper, called also Shamo ("Sea of Sand"). To the west of this the country rises, but probably sinks again, where the river Tarim, the branches of which run through Kashgar and Yarkand, flows into the lake Lob. Four chains of mountains confine this valley, the Thian Shan and Altai to the north, the Kuen Lun and Himalaya to the south. North of the Thian Shan lies the plain of Dzungaria, south of the Kuen Lun that of Tibet. The Altai Mountains cover an extent of country equal to France and England united. They rise to the height of 12,000 feet, contain many snow-covered peaks and glaciers and numerous rivers, and are rich in metals. The Thian Shan range is eight times as long as that of the Pyrenees, and is also rich in minerals: it loses itself in the plateau of Gobi, and its axis of elevation is

continued in the In-shan Mountains. The Kuen Lun chain runs uniformly west and east, and is prolonged to the east by the Nan Shan and Ala Shan, to the west by the Hindu Kush and the Elburz Mountains. The highest point of this chain is in the Hindu Kush Mountains, and is 21,500 feet high. The Himalayas extend from the Indus to the Brahmaputra. Some English travellers have pointed out that this range, as well as the Kuen Lun, is to be considered only as a series of buttresses thrown out from the plateau of Tibet, and that the axis shown in maps is simply a line joining the principal peaks and not a true axis of elevation. A large plain stretches from the mouth of the Indus to that of the Brahmaputra. To the north of this, in the north-western provinces, the Sivalik Hills, 3000 to 4000 feet high, rise abruptly from the level country. Between these and the general mass of the mountains lie valleys at an elevation of about 2500 feet. The first range of the Himalaya extends a distance of nearly 500 miles, and has an average altitude of 7000 feet. About 60 or 70 miles beyond this range rise the lofty mountains, of which some attain to the height of 28,000 feet and more. They are grouped together in huge masses, and are separated by deep hollows and narrow ravines. Beyond these, again, lies a plain through which the Sutlej flows, and which is bounded on the north by the Karakorum mountains. The elevation of its central part is about 15,000 feet. The geological formation of the Himalayas, and still more of Tibet, is very remarkable. In the latter district a tertiary formation, consisting of rounded pebbles and gravels, attains a height of 15,000 feet, its strata being appreciably horizontal. Here are found the remains of elephants, rhinoceroses, horses, etc. It seems probable that this plain, and therefore the Himalayas, have been raised to their present altitude since the tertiary epoch.

The central plateau is surrounded by smaller plateaux and terraces, leading down to the low country on the coasts. Numerous rivers cross these terraces. To the north flow the Irtish, rising in Lake Zaisan, the Yenesei, the Lena, and the Amûr. These rivers are navigable for a large part of their course, but their lower reaches are frozen up in winter, whereby floods are caused in their tributaries, so that they cannot be extensively used as a means of communication. China, on the contrary, is admirably provided with water-ways. The rivers Hoang-ho (Yellow River), and Yang-tse-Kiang (Blue River), 2300 and 3300 miles long respectively, each of which drains a surface of 700,000 square miles, are connected by numerous canals, which convert the space between them into an immense delta. The rivers of Further India run parallel to each other. Little is known of them except their mouths and lower courses. The Ganges is 1940 miles long, and drains a surface of 400,000 square miles. The Indus runs in an opposite direction, and, since it bounds the western plateau, may be considered the true division between eastern and western Asia.—*Count Meyners d'Estray, Revue de Géographie*, June and September 1888.

The Barisál Guns.—The phenomena known by this name are heard, not only at Barisál, but all over the south of Backerganj and Jessur. Babu Gaurdás Bysack brought the subject before the Asiatic Society of Bengal at their meeting in March last.[1] The reports were stated to occur at regular intervals, most frequently in the rainy season, and after, or immediately before, a heavy shower. They are generally accompanied by a southerly wind. The causes of this phenomenon have not yet been discovered. The principal supposed sources are the following: the breaking of surf rollers on the shores of the upper part of the

[1] Vide *Proc. Asiatic Society of Bengal*, No. iii., March 1888.

Bay of Bengal, the sound of which is carried inland along the river channels; the breaking down of river banks; the firing of guns and bombs at marriages; subterraneous or subaqueous agencies; atmospheric electricity; the bursting of bamboos, and the falling of trees in the jungles. As regards the last two, there is no evidence concerning them, and therefore they may be passed over in silence. The reports are heard in the Sundarbans, where no marriages are held, so that the gun and bomb-firing is not, at any rate, the sole cause. The theory that they are produced by the breaking of surf on the shore seems the most plausible. Mr. Pellew stated in the *Proceedings of the Asiatic Society* for November 1870, that he had seen from Púri, after the south-west monsoon had abated, a lofty wave break far to the south, while at the same time a noise as of guns was heard. The noise is rarely heard far inland, except at Chirra Punji. Unfortunately no particulars are known regarding the circumstances under which the Barisál Guns were heard at this place. But Lieutenant-Colonel Waterhouse pointed out that it lies in the line of direction of the Megna River, and that cannon had been heard at considerable distances. To the objection that these sounds are not heard in other deltas, it may be answered, that the situation and aspect of these deltas are quite different from those of the delta of the Ganges, or that the deltas are on a smaller scale. The theory that the Guns are produced by the fall of river banks is not supported by any evidence, and the fact that they are heard in the Sundarbans tells against it. There is no direct evidence that these sounds are produced by any subterraneous or subaqueous agencies, but Captain Stewart, as mentioned by the President, attributed them to volcanic explosions under the *Swash of no ground*, to which he assigned a volcanic origin. It seems more probable that the depression so called, which lies in front of the delta, is formed by the sands borne down by the river through its numerous mouths. It would, however, be well to examine the state of the sea over this depression during the monsoon. Mr. T. D. La Touche declared that the bursting of bamboos resembled rather the sharp crack of musketry than the thunder of heavy guns. On the other hand, he affirmed that he had heard Barisál Guns in the Garo Hills, too far from the gulf to be caused by the surf. It will be seen that the question is far from being solved, and, indeed, that sufficient evidence has not yet been collected. The truth probably is, that the guns are due sometimes to one cause, and sometimes to another.

Diego Garcia.—Diego Garcia is a coralline island in the Chagos Archipelago, which lies to the south of the Maldive Islands, in lat. 7° 14′ S. and long. 70° 26′ E., and has now passed entirely into the hands of a British company. The names of the settlements are Point Marianne, East Point, and Ninni-Minni, the last being the residence of a Government official. The island stands only a few feet above the water. Almost the only trees which thrive there are palms, which yield the only article of export, copra. Provisions are scarce and dear, for sheep and cattle do not succeed well, and therefore pigs and fowls only are kept. Fish may be caught, and there are two kinds of land crabs. Small quantities of lemons, custard apples, tamarinds, gourds, bananas, and other fruits are to be had. No spring water is found on Diego Garcia, so that rain water has to be collected in cisterns. The climate is agreeable, but rather wet. Europeans are generally attacked by dysentery soon after their arrival, and cannot remain more than twelve months at a time on the island.—*Globus*, Bd. liv., No. 21.

Meteorological Observations in North Borneo.—The records published by Dr. J. H. Walker, principal medical officer, show that the mean temperature was lower

in 1887 than the year before, except at Papar. The highest daily maximum 96° F., and the lowest, 62°, were both registered at Kudat. The mean for the year varies from 86°·59 F. at Kudat to 84°·34 at Silam. In Sandakan, the directions of the prevailing winds were south-west, south-east, and north-west, the south-west wind blowing 308 days. In Kudat the north-east wind blew 203 days, and the south-west 153. The mean temperature of evaporation was 77°·09; the highest reliable record 84°. The mean relative humidity was 80°·20; the highest months were January and December, and the lowest September. The barometric observations were somewhat faulty.—*British North Borneo Herald*, Sept. 1st, 1888.

AFRICA.

The Country of the Bashilange.—*Petermann's Mitteilungen*, Bd. 34, No. xii., contains an account, contributed by Lieut. Wissmann, of this district of the Congo basin. It is bounded by the river Kassaï on the west, extending northwards nearly to the confluence of the Lulua, and on the east touches the river Lubi. The people of the present day are a mixture of the true autochthonous Bashilange and of Baluba invaders from the east. They must have inherited their bodily characteristics from the Bashilange, for they are generally narrow-chested, small-boned, long-limbed, and by no means muscular, whereas the Baluba have muscular, sturdy figures. They use both the bow and the javelin, which also is a sign of a mixed race, for in Central Africa the limits between the bow- and the javelin-bearing tribes is very clearly defined. They come under four divisions :—The Bashilámboa, the Bashilambèle, the Bashilakassanga, and the Bena-Luntu. The first three are rapidly losing their distinguishing characteristics, and it is already difficult to decide to which of the three a tribe belongs. Fourteen years ago tattooing went out of fashion. The Bena-Luntu resemble the Baluba more closely than the other Bashilange, and, like that people, paint and do not tattoo themselves. They are much wilder than the others, and are, perhaps, cannibals. All these divisions are subdivided into a large number of tribes, and these again into communities and families. About twenty-five years ago the smoking of hemp came into fashion among the first three divisions. Though it may have had a deleterious effect on their constitution, and have to some extent lowered their physical standard, it certainly had a civilising influence, both by mollifying the wildness of their disposition and, indirectly, by obliging them to engage in trade with their neighbours, in order to procure the hemp, the home supply being insufficient. The Kioque, a very enterprising race, were the first to bring guns into the country, and they imposed on the natives most shamefully in their dealings with them. They were followed by the Bangala, and now European influence is becoming paramount. The country sinks uniformly in a north-westerly direction from an absolute altitude of about 2700 feet down to 1100. On the ridges dividing the beds of the streams, laterite, generally red, but occasionally yellow, is found. This rests on horizontal strata of soft yellow sandstone, which in turn lies on plutonic rocks, granite and gneiss, and, where the sandstone is absent, the laterite lies immediately on the granite or gneiss. The formation of the land is entirely due to the action of water: were the valleys and ravines filled up, an even plain would be formed. All the valleys are clothed with woods, and the country is abundantly watered. Most tropical plants, such as sugar-cane, rice, cotton, India-rubber trees and palms, thrive here, sometimes in a wild state, as coffee for instance. Among the treasures of the woods still unexamined may be mentioned dye-woods and oleaginous fruits. The Bashilange cultivate all the African crops, and, since

Messrs. Wissmann and Pogge's arrival, rice. Tobacco turns out well with proper attention. Pine-apples, bananas, limes, planes, etc., have been successfully introduced, as also vegetables—onions, tomatoes, lettuce, radishes, carrots, kohl rabi, etc. *Tragelaphus scriptus* and the red tapir are the only large game. Elephants and buffaloes have migrated northwards; leopards, lynxes, and wild cats are found, jackals and wolves but seldom, and lions and hyænas hardly at all. Hippopotami and crocodiles abound in the rivers. Rodents are the most common genus, and occupy a prominent place in the natives' bill of fare. This part of Africa generally is not rich in birds. Guinea-fowls, pigeons, and prairie hens are numerous owing to the extensive sorghum fields, but there are no suitable resorts for water birds. The grey parrot, the rhinoceros bird, the buzzard, and the weaver bird are the most common. Snakes are very numerous, especially poisonous ones, and of these the puff adder is most frequently met with. Termites render house-building a very anxious business. Cattle, European dogs, ducks, and fowls of good breeds have been introduced. The Bashilange show great eagerness to imitate the whites, and have quickly acquired some of the manners of civilisation. Their great fault is aversion to hard work. When they first commenced to trade there was abundance of ivory in the country and india-rubber could easily be procured. Now that the elephants have migrated and india-rubber is becoming scarcer, while the needs of the natives are growing more numerous, they may at length be induced to work, and then they will probably progress rapidly.

Bammaku, on the Upper Niger.—Captain Conrad, late Commander of the Bammaku district, has published a few details concerning it (*Compte Rendu*, No. 15 of the Paris Geographical Society). This territory, bounded from the west to the north-east by Beledugu (the country of the Bambaras), on the east and south by the Niger, and on the south-east by the mountains of Manding, presents the form of a rectangle 18½ miles long by 12½ broad, and contains a population of about five thousand. The country is very diversified, forming a labyrinth of valleys and hills, some of which rise to a height of nearly 1000 feet. The village of Bammaku is situated on a large plain not quite a mile from the river, in latitude 12° 37′ 7″ N., and longitude 7° 51′ 45″ W. The French fort placed between the village and the mountains commands the Niger, Bammaku, and the route to Nita (to the coast). Formerly all the commerce of the Western Sudan converged to this territory, but just before the French occupation the wars of Amadu Sheiku, son of El Haji Umar and Sultan of Segu, and Samory, had considerably diminished its importance. Peace has at length been restored, a treaty has been made with the chiefs of Beledugu, by which caravans travelling to the French factories are to pass unmolested, and a carriage road has been made from the Niger to the Senegal. On the southern side, a convention signed by Samory recognises the French protectorate, and guarantees free passage to travelling traders. It may, therefore, be hoped that this district will soon regain its old position.

AMERICA.

United States: Arid Lands.—Among the grants which have become available by the passing of the Sundry Civil Appropriations Bill is one of 100,000 dollars for the expenses of an inquiry into the possibility of reclaiming the arid lands of the Western States. The amount of land at present worthless, but capable of improvement, is, according to Major Powell's estimate, equal to the area now under cultivation. But if only half be reclaimed, the result will be an enormous

addition to the resources of the country. Major Powell has discussed the question in a letter to the Kansas City *Times*. The prairies are, he says, treeless because they are arid, and not, as many have maintained, arid because they are treeless. Trees do not alter the total amount of rainfall, but they do affect the ground by causing violent storms to give place to gentle, soaking rain, by retarding evaporation, and affording protection against dry winds. These plains, or at least a large proportion of them, are not treeless because the rainfall is too slight, for forests of cedar and pinon (nut-pine) can be produced with an annual rainfall of little more than ten inches. But, though this is sufficient moisture to support the life of trees, twenty-five inches are required to preserve them from destruction by fire. Major Powell considers that large uninhabited tracts cannot be reclaimed, because trees can only be protected from fire by men living near them. Tracts, where the rainfall is deficient, may be irrigated, and then planted with trees. Not all such lands can be irrigated, for the water supply would not suffice, but, as forests extend, they will prevent the water from running off at once to the river and the sea, and thereby cause greater evaporation, and, consequently, a more humid atmosphere, so that less irrigation will be necessary. Of course there will still remain some lands, where the soil is so stony, or the available water so small in quantity, that it would be impossible to attempt any change, but such lands will be a very small proportion of the present wastes. —*Science*, October 12th, 1888.

The Volcanoes of Central America.— Professor G. Pennesi recently gave a lecture on the geographical distribution of volcanoes in Central America, before the Italian Geographical Society (*Bolletino della Soc. Geog. Italiana*, October-November 1888). He remarked that a girdle of volcanoes runs round the Pacific from the Oceanic Islands through Japan and Kamtchatka to the Aleutian Islands, and then follows the western side of the continent of America. Though the chain of elevations is more continuous in America, Professor Pennesi does not recognise the existence of an unbroken backbone running from Behring Strait to Cape Horn, attributing the general acceptance of this view rather to the paramount authority of A. Humboldt than to the evidence of facts. Virlet d'Aoust maintains that North and South America were once separated, and several lines of division may now be traced in the region, which, by its elevation, has connected these continents. Indeed, this central region, from the Rio Gila and Rio Grande del Norte in Mexico to the Isthmus of Panama, is a collection of plateaux buttressed and surmounted by peaks, ridges, and chains more or less connected with one another. The Mexican mountain system terminates at the Isthmus of Tehuantepec, a long valley drained by the Rio Segovia or Coco separates the plateaux of San Salvador and Honduras from those of Nicaragua, a third break in the system occurs at the valley of the San Juan, which flows out of the lake of Nicaragua, and the bed of which is only about 130 feet above the level of the sea, while again at the Isthmus of Panama the maximum elevation does not exceed 260 feet. Volcanic action gradually increases in intensity from the extremities of the New World until it reaches a maximum in this central region. The volcanoes here follow a principal line of upheaval running along the shore of the Pacific, and short subsidiary lines at right angles to this. The highest of these summits attain a height of over 11,000 feet. Professor Pennesi gives a detailed account of the principal craters, the convulsions that have taken place in them, and the havoc they have caused in the surrounding country. A notion of the vast amount of subterraneous energy present in this country may be gathered from the fact that between the lake of Nicaragua and the Pacific, over an area

of barely 7228 square miles, no less than thirty volcanoes may be counted, some but lately extinct, others dormant, and the remainder in great activity.

AUSTRALASIA AND OCEANIA.

The Flora of Victoria.— A history of the progress of knowledge as regards the Victorian flora, contributed by Baron F. v. Müller to *Victoria and its Metropolis: Past and Present*, has been published in the form of a pamphlet, and sent to us by the author. The first botanists who landed in Victoria were Dr. Robert Brown and Antoine de Jussieu; they accompanied Captain Flinders in 1802. The results—given by Dr. Brown in his *Prodromus Floræ Novæ Hollandiæ et Insulæ Van Diemen*, a most important work, though, unfortunately, the second volume never appeared—are so far unsatisfactory that the Victorian plants are indicated only as natives of the south Australian coast. Sir Thomas Mitchell, in 1836, and other travellers made some additions to the number of plants then known, but it was not until 1853 that any systematic explorations of the country, with the object of obtaining botanical specimens, were undertaken. In that year a Government botanist was appointed (Baron von Müller himself), who searched the country from Port-Phillip to the Ovens River, gathered the first really Alpine plants on the summit of Mount Buller, and crossed Gippsland from the Bunyip River to Port Albert and Wilson's Promontory. These journeys brought to light an enormous variety of *Eucalypti* and the exuberance of the tree-ferns. The Murray River, the Australian Alps, and the unoccupied country beyond the Snowy River were afterwards visited. The great fan-palm (*Livistona Australis*) was found near the Brodribb River, and numerous climbers were collected, which usually grow in tropical countries. It was proved that acacias predominate in Victoria as well as in other parts of Australia, and that many species, believed until then to be peculiar to Tasmania, grow in Victoria also. The quick growth of the *Eucalyptus* was remarked, and the deleterious properties of some shrubs and trees, such as certain of the *Swainsoniæ*, were discovered. In 1855, the Government botanist explored the whole central portion of the Australian Alps; in 1857 the Cape Otway ranges; and, in 1860, he made the first ascent of Mount Baw-Baw, and discovered the sources of the Yarra, Goulburn, and Latrobe rivers. *Eucalypti* of enormous dimensions and immense *Todea* ferns were seen, and the occasional occurrence of orchids, passion-flowers, and other indigenes of the tropic zone was proved by the collection of specimens on the Genoa. Other botanists have also made collections on a smaller scale, but a portion of the Hume district, a large portion of East Gippsland, particularly the Waratah country, and the desert south and south-west of the confluence of the Murray and Darling rivers remain to be searched. The flora of Victoria is nearly twice as rich as that of Britain. An herbarium was commenced in 1857 in the Government House reserve, which has been enlarged by the gift of several private collections, and now contains 650,000 sheets. It ranks therefore with the great herbaria of the world, and it is particularly rich in Australian specimens.

The Highlands of Lake St. Clair, Tasmania.—This lake lies in the interior of the island, west-north-west from Macquarie Harbour, under the 42d parallel of south latitude. Starting from Marlborough, a town nearly in the centre of the island, the path proceeds westwards at an average elevation of 2300 feet above the sea-level. About ten miles from Marlborough the forest gives place to button-rush

plains, with here and there belts of stunted gums. The country between Lake St. Clair and King William Mountain to the south has the same character. The lake at the broadest part is about eleven miles long and two wide. Except at the southern extremity, its shores are but little indented. Along the eastern shore extends the edge of the great lake plateau, its steep escarpment being covered with gum forest. Near the northern end, Mount Ida (3600 feet ?) stands alone, separated by a deep gully from the plateau. On the other side of the lake, rather further to the south, Mount Olympus, a wall-like formation of basaltic greenstone, rises to a height of 2300 feet above the lake. It is in the form of an irregular figure of eight, and has an altitude above sea-level of 4680 feet. Its summit is flat, and overgrown with alpine vegetation ; its sides are generally steep. The lake is drained by the river Derwent, which is joined at a short distance by the little Traveller River, which carries off the water from the small lakes of the same name lying to the east of Lake St. Clair. King William range, already referred to as lying a few miles to the south of the lake, is a mountain plateau, rising gradually to a height of 2000 or 2500 feet above the plains on the north and east, but descending precipitously on the west into a deep narrow gorge, which divides it from the Loddon Hills. On the northern side lies St. George, a lake with the outline of a sea-horse, surrounded by three smaller sheets of water. To the north-west stands Mount Arrowsmith (3000 feet), and behind it Mount Gell. The largest bushes, which grow on the moor covering the summit of the plateau, are *Orites acicularis*, and the dark-green-leaved gum, *Richea Gunnii*, but round the lake grow a few bushes of *Hakea lissosperma* as high as a man. Little animal life is to be seen on the plateau ; quadrupeds especially are scarce. Flocks of the Tasmanian honey-eater, the hill crow-shrike, a few rock swallows, and a pair of white goshawks were noticed by Colonel Legge during his visit to the mountain.—Paper by Colonel Legge in the *Papers and Proceedings of the Royal Society of Tasmania*, 1888.

Sutherland Falls, New Zealand.—This newly discovered waterfall is situated near Lake Ada, about sixteen miles inland from Milford Sound. It was discovered by Mr. Sutherland, a Scotsman, and a well-known explorer and mineral-seeker along the west coast. In the neighbourhood are several mountains, three of which have been named—(1) Mount Sutherland, which rises 2000 feet above the falls, and is too steep to admit of any large quantity of snow remaining on its sides ; (2) Mount Hart ; and (3) View Mount. The falls issue from a small rocky defile, and reach the bottom of a perpendicular precipice by three leaps. The first leap is 815 feet in height, the water falling into a natural basin in the face of the cliff, from which it issues, only to fall again for a distance of 713 feet, and then dashes over the final leap of 388 feet into a deep pool at the foot of the rock. The total height of the fall is thus 1904 feet. The volume of water is sufficient to prevent its mostly passing off in spray, so that it comes down in a solid mass, causing a terrific roar. Observed from some distance, a rainbow of circular form is seen in front of the tumbling water, which decreases in size as it is approached, until it becomes no more than a yard in diameter. Lake Ada is full of snags, and the following theory of the origin of the lake has been advanced :—A heavy avalanche, having come down from the neighbouring mountains, formed a moraine, or dam across the Arthur River, the waters of which were thus forced back and spread out over an area of country, thickly covered with birch trees. These trees rotted away between wind and water, but the sunken parts seem to have been preserved, and now remain in the form of snags, making canoe navigation both difficult and dangerous.

Fiji.—The *Fiji Times*, of the 10th and 14th November last, describes an exhibition of native products, organised by the new 'Agricultural and Industrial Association of Fiji;' and it is expected that this association will have valuable results in promoting co-operation, and the interchange of information, among the planters and settlers scattered in different parts of the group. The exhibition itself was a success, showing, among other items, some valuable specimens of timber (among them one which shows exceptional durability under water), and various useful fibres (coconut, jute, pine-apple, Yau (*Paritium tiliaceum*), aloe, and others), besides sugar-cane, tobacco, tea, rice, cardamoms, tapioca, and various fruits, fresh and preserved, an important industry, for which the market is increasing. It is thought that vanilla may be also grown with advantage. It is stated also that, among mineral products, gold was exhibited, the presence of which has hitherto always been doubted. Amid the heavy losses of the last few years, the colonists have not lost hope. The Governor, Sir John Thurston, whose energy and intimate knowledge of the resources of the islands are undoubted, urges the establishment of paper mills, and announces the foundation of a department of Agriculture and Horticulture, as well as a museum of Commercial Products, all which under the circumstances should be of much practical benefit. The Suva Chamber of Commerce, which had discontinued meeting, is also to be resuscitated.

ROUTES, RAILWAYS, CANALS, ETC.

Proposed Ship Canal at Birkenhead.—The risk and delay which attend the entrance of a vessel into the port of Liverpool, owing to the extensive sand-banks at the mouth of the Mersey, are very generally known; and many passengers can remember, with what impatience they gazed at the town while tossing about outside the bar and waiting for the tide. The *Times* of 29th November last gives an account of a proposal which, if carried out, will render the Mersey more accessible. It is a revival of a scheme, started in 1838, to connect Wallasey Pool with the Irish Sea by cutting through the low-lying plain of Leasowe. Liverpool, jealous of her rising neighbour, has made little use of the docks along the East Float, the lower part of Wallasey Pool, which came into her hands by purchase. It is therefore fortunate that Mr. Vyner of Bidston still retains power to build docks on the West Float, and has a right of passage to the Mersey. From the upper end of the West Float a canal is to be cut to the west end of the Leasowe embankment, somewhere near Dove Point, where a tidal channel, carried through the foreshore and the sandbank known as Mockbeggar Wharf to the Rock Channel, will connect it with the sea. The tidal channel will be protected by a breakwater extending from the Leasowe embankment to a point in the Rock Channel west of the Dovespit, and the Rock Channel itself will be sheltered by another breakwater running in an easterly and south-easterly direction from a point in the East Hoyle Bank opposite to the village of Great Meols. This channel is to be dredged to a depth of 30 feet below low-water mark, and the tidal channel will be widened at its eastern end to form a float or basin. Railway communication with Birkenhead exists already, and may easily be increased.

Massowah.—Last March a line of railway was opened, running from Massowah to Saati. Its length, according to the *Bollettino della Società Africana d'Italia*, Fasc. ix. and x., is 26,885 mètres, or nearly 16¾ miles; the breadth of the gauge is 0·95 m., or a trifle over 3 feet; and the cost of construction was

about three million lire (£120,000)—a small sum considering the difficulties of the undertaking. The railway starts from a quay on the peninsula of Abd-el-Kader, and, crossing the plain of Otumlo, skirts the hills on the right bank of the Wissa River. A heavy storm in November 1888 flooded the river, and did some damage to the works, but it afforded the engineer a timely opportunity of judging what span should be given to the bridges. Elsewhere, also, special contrivances were necessary to facilitate the escape of water. From Otumlo the line passes on to M'Kullu and the valley of the Amashat, and reaches its terminus at Saati. Adverse critics affirm that the line will commercially be a failure, because it does not follow the route taken by caravans through the Lebka valley. This route, however, is not so suitable for a railway, and, should the line be prolonged to the fertile valley of the Demas, and be carried up to the table-land with a toothed rail, a new arrangement of trade-routes will be the consequence.

Siamese Railways.—His Majesty Shulalun Koru of Siam is a man of enlightenment, and is anxious to introduce European improvements into his country. Telegraph lines connecting Siam with China and Burma have been laid down; the kingdom has joined the Postal Union; and, now, railway communication is shortly to be established. The trade of Siam is estimated at £3,600,000. The chief products are rice—much esteemed in China and Java—which forms the half the wealth of the country, sesame seed, different kinds of pepper, gums, gold, iron, copper, cotton, hemp, tobacco, precious stones, turmeric, ginger, sugar, coffee, etc. European articles of commerce find a ready market among the Siamese. It is, therefore, evident that this rich country is in need of railways to convey its produce to the coast, and distribute the imports through the country. A commencement is to be made by laying down a tramway along the principal thoroughfare of Bangkok, for which a concession has been granted to Messrs. A. J. Loftus and A. du Plessis de Richelieu. A company has been formed in Bangkok, with a capital of £53,900. The same gentlemen have obtained concessions for two railways, one of which is to run from Bangkok to Paknam, the other from Bangkok to Bang-Mai. Of the 45½ miles which compose the Bang-Mai line, 24 will traverse highly cultivated and densely populated country, 11 will lie in a region almost uninhabited, while the other 10½ will be carried through country poorly cultivated and thinly peopled; but, as these lands are exceedingly fertile, the railway will no doubt at once bring workmen and inhabitants to the parts now deserted. As for the Paknam line, it will run through admirably cultivated gardens, splendid rice fields, and immense plantations belonging to the King of Siam. Paknam—often styled the Sevastopol or Kronstadt of Siam—will benefit by traffic with the intermediary stations, and merchandise, which now descends the river to be shipped at Paknam, will find a quicker means of transport. The line will have to be raised three feet or so in certain places, in order that it may escape floods on account of marshy ground; but this will involve no serious difficulties, especially if M. Decauville's narrow-gauge system be adopted. M. Routier does not believe the report that Sir Andrew Clarke, as representative of a British syndicate, has obtained a concession for a third line to run from Bangkok through Laku to Zimmé, and that interest on the capital has been guaranteed by the Siamese Government. It is a fact that permission has been granted to survey the route, but the other reports have not been confirmed.—M. Clement Routier, Vice-Consul of Siam, in the *Bulletin de la Société de Géographie de Marseille*, tom. xii. No. 4.

The Railways of the World.—The following tables are taken from the German journal *Industrie*. The length of railways constructed were :—

	On Dec. 31st 1885. Miles.	On Dec. 31st 1886. Miles.
In Europe,	121,205	124,943
„ America,	154,988	165,077
„ Asia,	13,781	15,152
„ Africa,	4,284	4,511
„ Australia,	8,041	8,791
Total,	302,299	318,474

The greatest increase is shown in America—that is, in the United States, which alone possesses 137,953 miles. Canada, with over 11,000 miles of railway, already occupies a respectable position. There was little increase in Europe; what was done here was chiefly connected with strategical lines. Even in Russia the increase was not above 600 miles. The following are the figures for the principal European states :—

	1885. Miles.	1886. Miles.
Germany,	23,323	24,398
Austria-Hungary,	14,051	14,534
Great Britain,	19,165	19,328
France,	20,189	20,745
Russia,	16,456	17,017
Italy,	6,434	7,074

Asia is still much behindhand. Siberia has no railway at present, and China only for a short distance. But Russia has just opened her Trans-Caucasian line, and the British are extending the Indian railways, which have already a length of 12,880 miles. The capital embarked in railway enterprise amounts to 5450 millions sterling.—*Chamber of Commerce Journal*, Oct. 10th.

GENERAL.

River Courses : The Laws of Hydraulic Degradation.—Major Powell publishes in *Science*, November 16th, 1888, an instructive and comprehensive exposition of this subject, the result of over twelve years' study and observation, in which he treats principally of the action of streams on their beds. He enumerates three methods by which hydraulic degradation is accomplished—(1) General surface degradation by rain and streams, commonly known as "erosion"; (2) the cutting of channels by the rivers themselves, to which he chooses to give a distinct name, "corrasion"; and (3) the formation of cliffs or "sapping." In order that material may be carried down by a river, the rocks must be disintegrated, and the material loaded—that is, held in suspension. Both water and load move down under the force of gravity, but, as the load is of higher specific gravity than the water, it must in time sink to the bottom, and the distance, to which a particle is carried before it is deposited, will depend on its size and specific gravity and the

depth and velocity of the water. The greater the velocity along the stream the further will the particle be carried before it reaches the bottom, and the greater the depth the longer will the particle be in falling. Lastly, the smaller the particle, the greater, proportionally, is its surface, and, therefore, the action of the stream upon it. Besides the floating load there is also a driven load, that is, *débris* forced along the bed of the river by the impact of the water. This load, then, diminishes the energy of the water. Some energy is also lost by the collision of particles, but, in so far as these are subdivided thereby, transportation is promoted. By increase of velocity the depth of the stream is diminished, and the excursion of the particle remains of the same length, but the power of the stream to transport larger particles is enormously increased. It varies as the sixth power of the velocity. The load increases the volume by its own volume, and the mass at a higher rate corresponding to its greater specific gravity, and, therefore, adds to the energy of the stream. When matter falls to the bottom it has to be reloaded, that transportation may be continued. Obstructions in the stream may effect this, or the driven load may be converted into suspended load, when the water plunges over great declivities, but the chief agent is lateral corrasion. Deposits are built up until they form part of the bank of the river, and are subsequently carried away by the action of the stream. The friction of pure water being very slight, it is the load which is the agent of corrasion, and, of course, corrasion increases the load. Wherefore, other things being constant, the load and the corrasion vary together. The opposing forces of rain torrents and streams entering on both sides form a line of maximum depth in the bed of the stream, usually in mid-channel, but subject to local deflections, and this is also the line of maximum vertical corrasion, seeing that the driven load gravitates to the deepest part. The varying resistance to corrasion of different kinds of rock causes the channel to be divided into reaches of greater or less declivity according to the hardness of the rock, and more numerous as the strata are more tilted. If the declivity of the stream be such, that no part of the load is deposited, there will be no lateral corrasion, but vertical corrasion may deepen the bed, and form precipitous ravines, until a stoppage being caused by the fall of undermined cliffs, the force of the river is turned against its banks. Vertical corrasion is also turned into lateral corrasion, where a reach of lower declivity causes a portion of the load to be deposited. In times of flood the force of the stream is vastly augmented, so that the quantity of material corraded and transported becomes much larger, and large quantities are deposited when the waters subside. Hence affluents form dams at their mouths when their declivity is greater, or when flooded by local rains. Deposition is also caused by anything which obstructs the channel, as the fragments of sapped cliffs and logs of wood arrested in their course along the stream, which is thus forced into a circuitous channel. The case of a stream issuing from a mountain course of high declivity into a valley or plain of low declivity is noteworthy. Part of the load is deposited, the obstruction thus produced converts vertical into lateral corrasion in the mountainous course, whereby a gorge is produced, and the detritus is heaped into a fan-shaped slope at its mouth. These are some of the facts and principles cited by Major Powell as the most important guides to river engineering work. They may be sufficient to explain the merits of the methods employed to control rivers. A revêtement is futile, except for local and temporary purposes, for, if the declivity be insufficient to carry off the load, the channel will be choked by deposits and floods increased, while, on the other hand, if the velocity be too great, vertical corrasion will undermine the revêtement. Lastly, if the declivity be such that

the stream can just carry its load, the revêtement is not required. There are other methods more or less efficient: first, the removal of banks and bars, and the deepening of the channel by river ploughs. This must be done along the whole length, as far as the region to be protected extends. Then, the river may be shortened, either by establishing a nearer outlet, or by utilising cut-off reaches, by which means the declivity will be increased and the stream deepened by corrasion. Lastly, the head-waters of a river may be retained in reservoirs either during floods, so that the volume of the river may be equalised, or until its sediment is deposited, whereby the river will be partly deprived of its instrument of corrasion and of its obstructive material.

MISCELLANEOUS.

A movement is on foot in Norway to organise an expedition during next year to the **North Polar Regions** by way of Franz Joseph Land, the leadership of which is to be offered to Dr. Nansen.

The Swedish Geographical Society has presented to **Dr. Nansen**, for his splendid feat of crossing Greenland from east to west on snow-shoes, the Vega Medal, the only other recipients of which, so far, have been Nordenskiöld Junker, Stanley, Palander, and Przhevalski.—*Das Echo*, 31*st January* 1889.

A Reuter's Telegram from Tokio, 12th February, states that a **New Japanese Constitution** has been promulgated from the throne by the Mikado, the occasion being marked by great national festivities. The Constitution, which is founded on the German system, provides for the establishment of a House of Peers, partly hereditary and partly elective, a further portion of the members being nominated by the Mikado, and of a House of Commons composed of 300 members. The franchise is conferred upon all men having attained the age of twenty-five, and paying taxes to the amount of 25 dollars annually. Liberty of religion, freedom of speech and the right of public meeting are also granted. Parliament will exercise legislative functions, and will have the control of financial affairs within certain limits. The judges will be irremovable, except by a special law.

NEW BOOKS.

The Industries of Japan. By J. J. Rein, Professor of Geography in the University of Bonn. With 44 Illustrations and 3 Maps. London: Hodder and Stoughton, 1889. Pp. 570. English, Latin and Japanese Indexes.

The news telegraphed last month from Tokio that a new Japanese Constitution, based on the German system, had been promulgated from the throne by the Mikado, is in appropriate sequence to the policy which, for the last thirty years, has knit Japan with ever strengthening ties to the nations of Europe. Old Japan, which for so many centuries found its ideal in China, from whence, through Corea, it received and carefully fostered the elements of national life, has merged into the New Japan now so familiar to us in the surprisingly short period of about thirty years. That this rapid evolution—or rather revolution—is possessed of an element of inherent danger

to the country, the careful reader of Professor Rein's volumes will readily admit. The United States famous expedition under Commodore Perry (1854, which led to the restoration of the Mikado dynasty in 1868, to the abolition of the feudal system in Japan, and to the creation in the country of treaty ports and the consequent influx of Europeans, has induced also a forced growth of Western civilisation and thought which has its dangers as well as its advantages. The enlightened policy of the Mikado in sending the most promising and ambitious Japanese youths to Europe, in order that they might be trained under the European system of education, and in taking as his advisers and as the instructors of his subjects men of "light and leading" from Europe and the United States, has occasionally led to many evils arising out of self-seeking, place-hunting, and wasteful expenditure in experiments. Thus, Professor Rein instances the case of the *Kaitakushi*, an institution for the development of the resources of the island of Yezo, which was based upon American systems and organised and served by Americans. After expending vast sums of money, this institution collapsed, but not before many Europeans and others had contrived to pluck many "a golden feather." Yet Professor Rein states that a countryman of his, by individual perseverance and the intelligent adaptation of means to the end, established a thriving farm which might well have served as a model for others. Professor Rein goes exhaustively into the agricultural industries of Japan, and is thoroughly scientific in his treatment of the various products. As regards the mineral wealth of the islands, he says this has been immensely overrated, and he does not scruple to ascribe this error to the foreign mining engineers who, for personal reasons, were interested in over-estimating the mineral resources of the country. He adds: "These engineers were unable to find any new openings or beds of mineral, and returned home on the expiration of their contracts." In another place, Professor Rein says, "that the distribution of metals, like gold, silver, tin, lead, zinc, and mercury, is very small, and not to be compared to that of other countries; that iron and antimony are to be found in greater quantities, but that Japan is really rich only in coal and copper."

The present volume is the continuation of *Rein's Japan*, the English edition of which was published two and a half years ago, the original edition in German having appeared five years ago. The two volumes taken together, form our most authoritative work on the "Land of the Rising Sun." Undertaken at the cost of the Prussian Government, this work has involved many years of personal investigation and travel, and may be regarded as a monument of elaborate and precise research, creditable alike to the author and the Government which employed him. The *Industries of Japan* are treated under the following heads:—(1) Agriculture and Forestry, and Agricultural Industries; (2) Mining; (3) Art Industry and related Occupations; (4) Trade and Commerce, etc. Into all these subjects, which are sub-divided under several heads, Professor Rein enters with conspicuous ability; his mastery of details is astonishing, and his treatment is always scientific. Incidentally, a considerable amount of geographical information is to be obtained. Every stage, from the natural product to the finished article of commerce, is carefully described and illustrated. The illustrations to the text are triumphs of lithography, and some are works of art in themselves; for the most part they are *facsimiles*, and scarcely distinguishable from the original objects they are designed to illustrate. The publishers are to be highly complimented on their work, in thus giving to the public one of the most attractive and valuable volumes it has been our pleasure to review.

A Personal History of the Euphrates Expedition. By WILLIAM FRANCIS AINSWORTH, Surgeon and Geologist to the Expedition. 2 vols. London: Kegan Paul, Trench, and Co.

Fifty years, in the annals of the Euphrates and Tigris, are but as a single twelvemonth in the record of other streams that have become the successors of the rivers of Babylon as seats of power and places of exile for wanderers. Still, the reading of a personal narrative of an expedition fitted out in the reign of William IV., and dealing with events when Ibrahim Pasha was a terror in Syria, does seem like going back to the "ancient history" of Geography. Dr. Ainsworth does not explain to us why his account of an enterprise, which he truly describes as without a parallel in the history of undertakings of the kind, should have been delayed till a date when nearly every one of the companions of the veteran author are long since dead and forgotten; further than by remarking that other narratives have been inadequate, either as too detailed or too abbreviated—a reason that has held good these forty or fifty years. Whatever has belated his story, no one interested in this supremely important region of the East can regret that it has been published at last. The narrative has had the good fortune to appear opportunely, for, after half a century's sleep, it has seen the light at a time when archæologists are busied over the identification of the sites and the deciphering of records of the ancient empire in Mesopotamia, Chaldæa, and Assyria, which the Euphrates Expedition did so much to bring to the knowledge of science, and when politicians and merchants are specially concerning themselves with the opening up of the Karun River—"the highway to Susa"—which, with its commercial possibilities, as they appeared in 1836, Dr. Ainsworth describes in words that apply with but slight change to the state of things to-day. It would be an endless task to go over the list of the places visited by the traveller, the adventures he met with, and the problems which he endeavours to solve. Suffice it to say, that in addition to the main lines of the Euphrates and the Tigris, with the almost unrivalled riches of historical, archæological and geographical interest strewn along their banks, his travels included excursions into the Taurus range; to ancient sites in Cilicia, and to Cœle-Syria and the country of the Ansarians, whose peculiar tenets, like those of Yezidees, the Sabæans, and other strange Eastern sects, he seeks to explain and free from the mythical matter that has gathered about them in the records of "second-hand" travellers. They also embrace explorations in Northern Mesopotamia, where Dr. Ainsworth visited and identified, as he believes, the places associated with the early wanderings of Abraham, as well as with the later history of Hittite, Assyrian, Persian, and Roman power; a journey from Bushire to Shiraz and the sculptured caves of Shapur, and investigations and adventures at the head-streams and tributaries of the Tigris. In all this wide range of time and of space, the author shows himself to be well abreast of the most recent discoveries in these historic lands, and his own narrative and observations have in them much of abiding interest and value.

Seas and Skies in Many Latitudes; or, Wanderings in Search of Weather. By the Hon. RALPH ABERCROMBY. London: Edward Stanford, 1889.

Merely as a book of travel, this volume is of unusual interest; the wide sympathy and scientific training of the author have led him to select for description and discussion the salient features of each place and people he had occasion to visit, and in every case he gives the result not of cursory observation, but of careful investigation. Picturesque descriptions of scenes and customs are thus

combined with such statements of fact and figures as render the pages as valuable for reference as they are for recreative reading. The journeys which have formed the basis of the record were—first to Canada, then round the world by Gibraltar, Naples, Suez, Melbourne, Fiji, New Zealand, Rio de Janeiro, and again by the Cape, Mauritius, Adelaide, Ceylon, Calcutta, East Indies, Hongkong, Japan, San Francisco, and New York; while a short summer trip to the White Sea introduces the author and his readers to the meteorology of Northern Europe just outside the Atlantic weather system. Observations of weather and sky form the *raison d'être* of the journeys and of their publication, and we know of no more satisfactory popular description of the many important phenomena here discussed. The systematic attention paid to the aspects of the sky, as depending upon and illustrating the movements of the atmosphere, is the distinguishing feature of the work, and it is to this feature that its descriptions owe much of their vivid reality. The numerous photographs and excellent engravings will prove of great value to the reader. Of the many meteorological observatories visited, the Signal Office at Washington is the most complete, and the methods of fore-casting followed there are interesting as being typical of those now established in several parts of the world. But it is curious to learn that in the mountain observatory at Pike's Peak—at least at the time of the author's visit—while there was an excellent establishment manned by three observers, all observations were suspended from 11 P.M. to 3 or 4 A.M., that the only self-recording instrument was an anemometer, and that the telegraph wire had been broken for two years. With this, under the richly subsidised American Bureau, the work done at the Ben Nevis Observatory compares very favourably. The pleasant style in which the author describes the incidents of travel, the peculiarities of the climates of the places visited, the languages and myths of the peoples, and many objects of general or scientific interest, is sure to commend *Seas and Skies in Many Latitudes* to the reading public.

The Last Voyage to India and Australia in the "Sunbeam." By the late LADY BRASSEY. Maps and Illustrations. London: Longmans and Co., 1889. *Price* 21*s.*

This volume consists of the Journal of the last voyage of the *Sunbeam*, kept, until a very short time before her death, by Lady Brassey. It has been edited, apparently with much tact and judgment, by Lady Broome, and a short supplementary chapter by Lord Brassey completes briefly the story of the voyage. Apart from the pathos necessarily attaching to a volume produced under these circumstances, the work seems to contain all the elements which gave such wide-spread popularity to the author's former books. All the expeditions undertaken by the party are carried out with the same abounding resources and energy, and described in the same clear and graphic way, though the narrative is interspersed as it proceeds with many allusions to failing health and power; and there are the same pleasant and amusing pictures of the family life while at sea. The well-known fame of the *Sunbeam* made her arrival an important event anywhere, and among the hospitable and perfervid Australians the expedition resembled a royal progress. Of the lesser-known localities visited, there are interesting notices of our colony and protectorates in North Borneo, and of the islands in Torres Straits. In these seas Lord Brassey's well-known skill as a navigator was often critically tested. The illustrations are artistic and attractive; and in the concluding chapter are some interesting remarks by Lord Brassey on the defences and value of some of our remoter dependencies, as St.

Helena, Ascension, and Sierra Leone—a subject of which he has elsewhere on more than one occasion urged the vital and immediate importance.

A Text-Book of Physiography or Physical Geography; being an Introduction to the Study of the Physical Phenomena of our Globe. By EDWARD HULL, M.A., LL.D., F.R.S., Director of the Geological Survey of Ireland. London: Deacon and Co. 1888. Pp. xxiv., 228.

There are a few excellent little text-books of Physical Geography in the English language, and a great host of very worthless ones. Professor Hull could not produce a work of the latter class; but, unfortunately, he has not succeeded in reaching the former. The book has not apparently been trammelled by the effort at conformity with special regulations: it was evidently required to fill up a series; the author had *carte-blanche*, it would seem, in everything but space, and there was an opportunity of giving a genuinely fresh and original sketch of the world as an organic whole. Instead of this, we have before us a good text-book of physiography, compiled from carefully acknowledged sources; its 207 pages of letterpress are systematised and sub-divided to a high degree: there are 24 pages of preliminary matter devoted to a synoptical table of contents, list of plates, preface, etc., and 16 pages of elaborate index at the end. But the result is unsatisfactory. The book is *very* small. Although it is printed with large type and wide-spacing like a three-volume novel, the great expanses of clean white paper at the beginning and end of the numerous chapters show an obvious effort to eke out the "copy." Had the printing been close, many of the foot-notes giving references to works that no reader of the book will consult omitted, and the index brought into a couple of pages, the wearisome repetition of the statement that space precludes the consideration of some highly interesting question might have given place to a perfectly satisfactory explanation. An author cannot be blamed for omitting much that a critic might desire to see in a book on physiography, for text-book-making is essentially the science of judicious omission, and each man must judge for himself what is judicious. The Congo, however, really should have a place amongst the great river-basins of the world, and there might have been found more recent sources of information for such statistics than Keith Johnston's *Physical Atlas*, unrivalled as that work is in all but youth. The maps are very rough sketches, more like blackboard diagrams than illustrations for a text-book. There are some statements brought back to light, which time had quietly removed from active service. The argument that the earth had volcanic craters as large as those of the moon, because the Pacific atolls are built on such, is one of these. It seems doubtful, also, whether the great density of sea-water *supports in position* the stupendous submarine mountains which are crowned by coral reefs. Yet, as a rule, the facts are carefully sought out, and skilfully put together; only they are not co-ordinated, which is to be regretted. The best chapters appear to us those dealing with the astronomical aspects of the earth, and with the magnetic conditions. But the historical development of most of the theories referred to throughout is better treated than in most small books.

Physical Geography of Mountains and Rivers, together with a General Explanation of Geographical Terms. By THOMAS PAGE. Fifth Edition. London: Moffat and Paige. Pp. 78. *Price* 1s.

That this little book has attained considerable popularity is evident from the fact that it is now in the fifth edition, yet the reason for this cannot be easily

accounted for, unless, indeed, it be on account of the definitions of geographical terms, which are clear and concise. The part of the work treating of mountains is copious and well arranged, but the heights given are frequently out of date and far from correct. For instance, Mount Everest is said to be 29,100 feet in height, Mount Aconagua (*sic*) 24,900 feet, Mount Elburz 18,000 feet, and Mount Kilima-njaro 20,000 feet. In the same way the drainage areas of the principal rivers of the world are stated in the roundest of numbers, as that of the Rhone 40,000 square miles, of the St. Lawrence 480,000 square miles, and so on. The work of running water receives but little notice, and examples of this important factor in the history of streams is almost entirely ignored.

Letters from Majorca. By Charles W. Wood, F.R.G.S. With numerous Illustrations. London: Richard Bentley and Son, 1888. *Price* 14*s.*

These letters from its talented editor have already appeared in the pages of the *Argosy*, but, as the Balearic Islands, their scenery, people, and customs, are so imperfectly known, it is well that the letters should be published in book form. Mr. Wood's style is always graceful and entertaining. He furnishes us with a graphic description of the scenery of Majorca (or *Mallorca*, as he prefers to call it, after the native fashion). He was fortunate in having, as a travelling companion, an artist of some talent, to whom we are indebted for the illustrations which form so attractive a feature in this volume. The absence of a map is felt. The letters are preserved in their original form without the addition either of an index or table of contents.

Persia. By S. G. W. Benjamin, lately U.S. Minister to Persia, "Story of the Nations" Series. Illustrated. London: T. Fisher Unwin, 1888. Pp. 304. Index. *Price* 5*s.*

In his history of Persia Mr. Benjamin professes to give, in the words of his preface, "a narrative of the most noteworthy characters and events of that ancient empire from its foundation in prehistoric times." The book is divided into twenty chapters, of which the first six deal exclusively with purely fictitious matter and heroic legends, which, however interesting from a literary point of view, occupy an undue amount of space in a text-book of this size. Only three chapters are devoted to the most important and brilliant period of Persian history—Cyrus to Xerxes—and several grave errors of fact are to be noticed in this section of the work. For instance, we are told (page 100) that Atossa was kicked to death by Cambyses, a statement somewhat difficult to reconcile with the reference (p. 112) to her subsequent marriage to Darius, and likely to raise doubts in the reader's mind of the author's accuracy elsewhere. The rest of the volume contains an account of Alexander the Great's invasion of Persia, the successive rise and fall of the Seleucian, Parthian, and Sassanian dynasties, the Mohammedan conquest, and political events up to the present day.

A chapter might with advantage have been devoted to the consideration of the Persian language, literature, and religion, not to mention many other characteristic phases of civilisation that are scarcely noticed. It is also a matter of regret that Mr. Benjamin—unlike most writers on matters of fact—considers it unnecessary to refer to the authorities he has consulted (*v.* Preface), as a selected list of standard works is frequently of great value to the reader who wishes to extend his knowledge of the subject.

Notes of Travel in the Islands of Tenerife and Grand Canary. By ISAAC LATIMER. Pp. iv. and 149. Plymouth: *Western Daily Mercury* Office, and London: Simpkin, Marshall, and Co., 1887. *Price* 1*s.*

The English in the Canary Isles, being a Journal in Tenerife and Gran Canaria. By S. FRANCES LATIMER. Pp. viii. and 340. With a Map and eight Illustrations. Plymouth: *Western Daily Mercury* Office, and London: Simpkin, Marshall, and Co., 1888. *Price* 4*s.*

These two little books give an account of the same visit to the Canary Islands, the former consisting of a series of letters contributed to the Plymouth *Western Daily Mercury*, whilst the latter is a more extended diary, accompanied by illustrations of a somewhat crude character. Miss Latimer's book gives the usual amount of incidental details which seem inseparable from a lady's diary, but at the same time she has fulfilled, in a highly creditable way, the task laid down in her preface, namely to "attempt to describe the life of the English in the Canary Isles, and to give an answer to the oft-repeated question, 'How did you pass the time in the Islands?' 'What was there to see?'"

The descriptions given of the climate, the people, and the recently-improved accommodation for visitors should be welcome, not only to the health-seeker, but to the geologist and the botanist, for whom the Canary Islands constitute a field of special interest. The maps are poor.

New Zealand of To-day 1884-1887, by JOHN BRADSHAW. Pp. xii. and 402. 2 Maps. London: Sampson Low and Co., 1888. *Price* 14*s.*

Kaipara; or, Experiences of a Settler in North New Zealand. Written and Illustrated by P. W. BARLOW. Pp. xii. and 220. London: Sampson Low and Co., 1888. *Price* 6*s.*

The bibliography of New Zealand has been largely increased in recent years, but it is by no means easy to select a work which is not either devoted to "writing up" some particular district for trade interests, or which is the production of a mere "globe-trotter," whose experience is too limited to justify one in attaching importance to his opinions.

It is little more than six years since Mr. Bradshaw wrote a book similar to the one before us, but there have been so many changes in the colony during that time, that it is already out of date. Like most men whose interests are identified with New Zealand, the author is very indignant with the views expressed in *Oceana*, and does not scruple to let the public know how Mr. Froude has misled them. Although agriculture is evidently the subject most congenial to him, on account of his long familiarity with it, Mr. Bradshaw deals at considerable length with a great variety of topics. The geographical position of the islands forming New Zealand, the condition and prospects of the native race, the frozen-meat trade, the financial state of the colony (a subject of present concern to many both at home and abroad), its political history, its educational system, and the vast subject of Imperial Federation—all are reviewed with care and intelligence. Although, perhaps, somewhat optimistic in regard to the near future, Mr. Bradshaw has added an Appendix containing statistical tables relating to imports and exports, land, wages, public debt, etc., which are intended to re-assure investors. The principal map, dated 1882, is hardly suitable for insertion in a book of "to-day"; the means of communication have been much extended since its construction, and there are many important omissions. Apart from this, *New Zealand of To-day* will repay careful study either by investors or intending settlers.

Kaipara cannot rank in importance with Mr. Bradshaw's book; it is a

popularly-written, and apparently truthful, sketch, mainly confined to a small corner of the North Island. The writer landed in Auckland in 1883, with the intention of following out his own profession of civil engineer, but, finding that no easy matter, he wisely resolved to try his hand as a settler at Kaipara, a district to the north of Auckland, instead of abusing the country itself, as so many do when their plans fail. He soon made himself acquainted with colonial out-door life, which he describes graphically, and, whilst writing favourably of New Zealand, he does not ignore its disadvantages in the way of over-government, high railway tariffs, etc. The author's illustrations form a useful addition to his narrative.

New South Wales: Her Commerce and Resources. By G. W. Griffin, United States Consul at Sydney. Sydney : Charles Potter, 1888. Pp. 293.

New South Wales is a hundred years old, and more than one book has recently impressed this fact upon the world. Most of these were written by persons directly interested in the well-being of the youthful centenarian. This volume comes from an outsider : it is dull, it is dry, it is intensely statistical, and absolutely devoid of literary pretension ; but it shows the skeleton of the country in its enormous strength and vast resources, and through all can be seen the beating of a heart of inexhaustible energy, destined some time to make it a great power in the world. Not one of the colonial enthusiasts, in their more elaborate treatises, has impressed us so strongly as this matter-of-fact American consul with the greatness and future of Australia. Incidentally a fact is mentioned that throws a serious light on British trade :—"Sir Julius Vogel, the late Colonial Treasurer in New Zealand, stated, in a speech at Auckland, that, from patriotic motives, the Government ordered from Great Britain a number of locomotives the same pattern as those made in the United States, but that when they were nearly ready for shipment to the colony, they were found to be so heavy that the engineer in charge of the New Zealand roads stated that some of the bridges would have to be strengthened before the locomotives could be put on the roads, and that they were much heavier than laid down in the plans and specifications. The English manufacturers replied that they could not make the engines of the limited weight prescribed. The New Zealand Government thereupon cabled to the United States for the required supply."

NEW ATLASES AND MAPS.

THE STUDENT'S ATLAS, in twelve circular maps (on a uniform projection and one scale). With two index maps. Intended as a *vade-mecum* for the student of history, travel, geography, geology, and political economy. With a letter-press introduction, illustrated by several cuts. By Richard Anthony Proctor. *London : Longmans, Green, and Co.*, 1889.

This atlas possesses the distinctive feature of all the maps (except those directly intended as index maps) being on the same central projection—the equidistant. The author divides the globe into twelve equal parts, corresponding with the twelve faces of an enclosed or enclosing dodecahedron, the regular solid with twelve pentagonal faces. He says : "If one imagines such a solid formed with its faces made of some elastic material, and the interior to expand until the flat faces become all so far curved as to form parts of one and the same spherical surface, the twelve spherical pentagons so produced would correspond with the twelve divisions of the globe in this atlas. But each map is made to include the spherical surface, circumscribing the pentagon really belonging to it, so that each map overlaps five others." Each map is on the true equidistant con-

struction, so that distances measured in the direction of a radius are on the same scale throughout. Distances measured at right angles to the direction of a radius slowly increase with distance from the centre, but even at the circumference of each map are only increased by 1-14th part—a divergence which is very easily taken into account.

ATLAS DE GÉOGRAPHIE PHYSIQUE ET MILITAIRE DE L'EUROPE ET DU BASSIN DE LA MÉDITERRANÉE. Par T. F. Paquier. Première edition. Contenant 6 cartes gravées et colorées, 50 cartons et 4 tableaux, pour servir à l'Histoire des Guerres des Temps modernes (1453-1886).

Paris: Librairie Géographique, Emile Bertaux.

EUROPE.

EUROPE, Geological map of ——. Executed under the direction of Joseph Prestwich, F.R.S., by William Topley, F.G.S., and T. G. Goodchild, F.G.S., from the latest surveys. *Oxford: Prestwich's Geology, Vol. II.*

AFRICA.

EGYPT.—Geologisch-topographische Karte der Kreide Region bei den Pyramiden. Von Professor Dr. G. Schweinfurth. Scale, 1 : 60,000.

Petermann's Mitteilungen, Jahrgang 1889, *Tafel* 1. *Gotha: Justus Perthes.*

WEST CENTRAL AFRICA.—Reduction of Mr. F. S. Arnot's Sketch-Map of his route from Benguella to Garenganze. Adapted to Justus Perthes' large map of Africa. Scale, 1 : 4,000,000.

Proceedings of the Royal Geographical Society, February 1889.

CAPE COLONY, New Postal Route Map of ——, and Adjacent Territories. Compiled from the most recent information.

Lithographed by R. Newbery, Surveyor-General's Office, December 15th, 1888.

SOUTH AMERICA.

AMAZONAS, Karte eines Thiels des peruanischen Departmento de ——. Aufgenommen von A. Wertheman, 1877 und 1882. Scale, 1 : 600,000.

Berlin: Zeitschrift der Gesellschaft für Erdkunde, 1889, *No.* 139.

OCEANIA.

NEW ZEALAND, Map of the North Island, ——. To accompany the *Land Guide* for December 1888.

NEW ZEALAND, Map of the Middle Island, ——. To accompany the *Land Guide* for December 1888. *Wellington: By Authority, George Didsbury, Government Printer, December* 1888.

NORTH POLAR REGIONS.

GRINNELL LAND, Map of, ——. From Discoveries made by Inglefield, Kane, Hayes, Hall, and Nares.

NORTH GREENLAND, Chart of Coast of ——. Lady Franklin Bay Expedition 1881-1884.

KANE BASIN AND SMITH SOUND, Map showing Drift, Travel, and Exploration of Lady Franklin Bay Expedition in ——.

REPORT on the Proceedings of United States Expedition to Lady Franklin Bay, Grinnell Land. By A. W. Greely. Vol. I.

Washington: Government Printing Office, 1888

GENERAL.

DIE VERSCHIEDENEN KARTENPROJECTIONEN.—Von Professor Dr. Umlauft.

Wien: Deutsche Rundschau für Geographie und Statistik, 1889, *Heft* 5.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

EXPLORATIONS IN THE ATLAS MOUNTAINS.

(*Read at Meetings of the Society, Edinburgh and Glasgow, February* 1889.)

By Joseph Thomson,

Honorary Member, Royal Scottish Geographical Society.

It was on May 22d of last year that I got my first effective view of the Atlas Mountains.

We had left Saffi, on the Atlantic sea-board, four days before with our little party of six men, mounted on horses and mules, and made our way through the provinces of Abda and Bled Hummel. For the first three days we had seen nothing to remark beyond the featureless and treeless monotony of the landscape, the matchless fertility of the plains, and the scantiness of the population. On the fourth day this had changed. We had entered a series of barren, rocky mountains, which ran through the province of Rahamna in a refreshingly picturesque variety of form, though of desolate aspect.

From these rugged peaks and serrated ridges we had at length emerged, and found ourselves suddenly confronted with the most striking spectacle that Northern Africa presents. At our feet spread an extensive plain of mottled green and gold, through which ran seaward a series of rivers. Here and there, in the otherwise featureless expanse, dark areas told of olive groves and fertile gardens, and white-washed tombs showed where holy men were buried.

In the centre of this great plain appeared an extensive tract of brown and green, from which loomed up a majestic tower. We did not require to be told that this was the minaret of the Kutubia mosque, and that around it lay the city of Morocco. We were yet too far distant to be able to distinguish the architectural features of the southern capital of the Empire; but it was sufficient to know that it was a city with a history—a city which had been the theatre of wars and sieges, and the residence of Sultans—to conjure up to our imagination something of the

"havoc and splendour of the East." Its very name—Maraksh, or city of Morocco—threw a glamour over its hidden features, and connected it with all the past glories of the Empire, and its achievements in war, in arts, and in science.

But it was neither the great plain nor the partially seen city which chiefly attracted our rapt attention. Before us loomed the majestic front of the Atlas Mountains.

Hitherto we had only got distant glimpses of some of the higher elevations of this great range, but now our eyes roamed from its dark bush and forest-clad base over its lower ranges, to the snowy masses which broke through a zone of grey cloud, and above it gleamed in dazzling whiteness against the deep blue sky.

Seen from our distant coign of vantage, the Atlas had an air of dominating and impressive grandeur. It seemed to break from the plain with cliff-like abruptness, and sweep up to a stupendous height, while irregularities of its culminating crest were brought into marked prominence by the gleaming snow which still clothed its upper zones, and extended here and there far down the mountain sides.

In itself there was much in this majestic panorama to lure us on to penetrate the deep glens and gorges which seamed its rocky sides, and to ascend the cloud-piercing heights which here and there broke from its crowning ridge. But there was another and far deeper attraction. We knew we were looking upon what was practicably a *terra incognita*—as little known a region as many in the heart of Africa. Hundreds of traders and travellers had reached its base, and made ineffectual efforts to penetrate its fastnesses, and lay bare its secrets: but the religious fanaticism and exclusiveness of the natives, the obstruction of the more suspicious officials, and the dangerous temperament of the mountaineers had formed a barrier which had baffled all infidel curiosity and enterprise.

Something had been done, it is true, to break through or evade the obstacles which sealed up the secrets of the Atlas by Sir Joseph Hooker, and later on by Lenz and de Foucauld, but, still, as a range, it lay practically unexplored, with all the attractive mystery of the unknown about it. Two ascents made and three crossings achieved, represented the work done in elucidating the geographical features of a range of mountains second to none in Europe or Africa in length and average elevation.

And now we had come to test our strength with the obstructive tactics of the officials, and the exclusiveness of the natives, determined to do our best to throw some further light upon the topographical characteristics and geological structure of the great range.

Yet, at the moment, we could not be very sanguine of success where so many had failed. An altogether unexpected class of difficulties had presented themselves. At the very threshold of our enterprise our little party of men on whom we were compelled to place our sole dependence, had shown themselves not only insolent and disrespectful, but mutinous and intractable in the extreme. They had joined us believing that we were a couple of greenhorns, with whom they could do what they liked, and, finding out their mistake, they had cut up rough. To have to fight against outside opposition was only to experience an added zest to travel,

but to know that there was treachery in the camp was to be utterly paralysed.

With these semi-despondent ideas in our mind, we resumed our march. In a couple of hours we entered the picturesque date-groves which encircle the northern aspect of the city and speedily reached the river Tensift, which we crossed by a bridge of some twenty arches. A broad road led us through a succession of rich groves and gardens. A continuous animated series of quaint scenes greeted our every step, and told of our approach to a great city. At length, about three in the afternoon, after having been ten hours in the saddle, the battlement gateway of Morocco loomed up before us, and soon we were within its walls and winding through its narrow streets to the house and garden placed at our disposal.

Our first impressions of the city of Morocco, this southern capital of the Empire, were those of unmixed disappointment. As we wandered through street after street and lane after lane, enclosed by red clay-built walls and houses of meanest aspect, we saw much indeed of the "havoc," but very little of the "splendour" of the East. At every step we found evidence of a nation on a down-grade slide, of a people who had lost all earthly hopes and aspirations and lived under the most grinding oppression and tyranny.

Morocco was a city grown slattern, very much out at elbows and utterly careless of its personal appearance. Yet, with all its air of meanness as we got rid of our preconceived notions, it again began to grow upon us. In the most unexpected places, often amidst tumbling ruins and all the signs of rapid decay, we were continually attracted by the sight of some interesting example of Moorish workmanship. Here it was a fountain, on which the artist had lavished all the wealth of his Oriental imagination, and shown all his manipulative skill in covering it with stucco or wood-carved arabesque, with intricate tile-work and brilliant colours. There it was the doorway of a mosque, horse-shoe-shaped and overhung with effective moulding.

We got delightful glimpses of mosque interiors too, all the more delightful because partaking of a spice of danger. These displayed beautiful wall decorations, Moors at prayers in the subdued light near the mihrab, and cool shady colonnades surrounding marble-paved courts, where sparkling fountains cooled the air and invited the faithful to make themselves clean before venturing into the more sacred precincts.

It is not, however, to its architectural features that Morocco owes its special charm. As in all Oriental lands, its most picturesque effects lie in its people and its street scenes.

The very beggars carry their rags with such an air, they appeal to the passer-by in such a high-flown and picturesque style of language, that they become not only objects of compassion but subjects for the artist. The women swaddled in their absurd blanket-like haiks, carry about with them all the charm and mystery of the forbidden and the unseen—and yet not quite unseen either, for those beautiful eyes of theirs, sparkling, with all their liquid brilliancy, between black-tipped eye-lids and long glossy eye-lashes, transfix the gaze of the onlooker and fire his imagina-

tion till he sees not only beautiful eyes, but face and form. Not least attractive are the portly Moors themselves, draped in their toga-like, creamy-coloured haiks, gliding along with a holy assurance of paradise in their faces, while the weather-beaten Berbers from the Atlas, the gaunt fierce-eyed Arabs from the desert, and the slinking Jew, all form effective elements in the scene.

It was in the purely business parts of the town, however, that we found most to admire. Motley throngs of buyers and sellers, busy workmen, and idle wayfarers, crowded the narrow thoroughfares, and, with the quaint box-like shops on either side, formed an exhaustless vista of interesting scenes.

On these aspects of Morocco it is not my intention to dwell; let us rather hurry forward to the less well known arena of our explorations.

On the 27th of May we fled clandestinely from the city, to avoid the interference of the authorities in our movements, and, travelling eastward over the even plain of Morocco, reached Sidi Rehal on the evening of the same day. Here we were at the threshold of the unknown, and at the very foot of the Atlas.

Remembering the dominating and impressive grandeur of the range when seen from the Rahamna Mountains, we had naturally expected that nearer approach would only magnify their effects. How severe, then, was our disappointment when, finding ourselves at its base, we sought in vain for the Atlas of the distance, with all the additional anticipated effects of proximity. Instead, we found ourselves staring up at a series of by no means picturesque low ranges of mountains, gently sweeping up some two or three thousand feet above the plain. A limestone escarpment running in an unbroken straight line along the face of a ridge, a gully cutting through the same, a whitewashed tomb on a hill-top, and a Shellach or Berber village clinging to its sides, were the sole substitutes for the beetling cliffs, the frowning grandeur of the range, and the snow-clad, cloud-piercing heights which we had been led to expect from the distant north. There the glittering crest of the Atlas had dwarfed all else; here the minor ranges massed round the base bulked chiefly in view, and made it difficult for us to realise that we were looking at the lower undulation of a great earth-wave, which swept up to elevations of 13,000 and 14,000 feet.

On the following morning we proceeded to Demnat, which we had selected as a suitable point from which to make our first attempt to enter the mountains so long tabooed to European travellers.

It was towards evening, when, after having been all day in the saddle under a sweltering sun, we turned away from the uninteresting plain and entered the valley of the Wad Demnat. We passed at first over a series of deep gullies covered with junipers and *Callitris* on the crests and slopes, and adorned with the pink bloom of the oleander at the bottom. This led us to grassy swelling hill-sides, rich with olive groves, where Berber boys watched over flocks of sheep and goats. At each step the valley passed more and more from the wild gypsy grace of Nature, and lent itself to the practical use of man. Grassy swards gave place to gardens terraced in little squares, and resin-scented conifers to useful fruit-trees and

the graceful vine. Soon the bridle-path became a veritable arcade, arched over by fruit-trees and walled in with bush and flower and creeper, which grew to right and left, with all the wild grace and prodigal profusion of the tropics.

On all sides, too, we heard the unwonted sound of water rushing along well-laid-out irrigation channels, carrying fertility to every square yard of the lower mountain slopes.

With such surroundings we no more remembered the weary hours that were past, nor the burning sun. We lingeringly rode onward, no longer eager to reach our destination. A little more winding and turning, however, a few more pleasant peeps of terraced slopes, of banks bright with many-hued flowers, and then we were confronted with the fort-studded walls of the town of Demnat, within which we speedily found shelter and protection.

The neighbourhood of the town of Demnat we found even more interesting, if less fertile and well cultivated, than its riant grass-clad valley. By dint of riding the high-horse and bullying the Kaid, or governor, we were enabled to make two excursions into the mountains. The first led us up the beautiful valley to where, a few miles above the town, it gradually narrows into a picturesque gorge. It was here that we discovered the remarkable bridge aqueduct of Iminifiri. This, I may venture to say, unique phenomenon, consists of an arch across the defile at a height of over 150 feet, which has been formed by the gradual deposition of lime held in solution by a stream falling from the heights above. This process has gone on till the tufa thus formed has reached the opposite side, and now the stream, instead of forming a waterfall on the east side of the gorge, does so on the west side, while 150 feet underneath runs the Demnat River. This deposit of tufa not only forms a fine stalactite-hung natural arch over the defile, but an aqueduct carrying a stream from one side to the other, and a bridge used by the inhabitants for communicating with the opposite mountains.

Above Iminifiri we passed through a range of mountains dominating the lower elevations that more immediately overlook the plain, and found ourselves confronted with a third and still higher series. We crossed numerous low ridges which coincided with anticlines of cretaceous limestone, the hollows or synclines being characterised by red shales and sandstones. At length we reached the base of this third series of mountains, and proceeded to climb its exceedingly steep and sterile slope, which corresponded with the sharp dip of the tilted limestone beds. On the lower parts we found magnificent groves of olives, but these speedily gave place to the more hardy conifers, evergreen oak, and several species of bushes. After a stiff climb we reached the top of the highest peak at an estimated elevation of from 5000 to 6000 feet. To our delight, we found ourselves confronted by the central crest of the range. It was here as we had pictured it from Rahamna, though greatly shorn of its magnificent proportions by the 6000 feet of its height which lay beneath us. Still it rose impressively in a massive almost unbroken wall with an even top from the pediment on which we stood. There were few other striking features to remark beyond its stern air of rocky desolation. Blasted by

winter's frosts and snows and summer's desiccating winds and burning suns, it yet defies, as best it may, the denuding agents of Nature and the desecrating foot of man. The snow still lay gleaming in great masses on its table-topped summit, and crept here and there down its sheltering crevices.

To add somewhat to the awe-inspiring influences of the scene, a great storm-cloud brooded over the mountain, from which flashed shafts of lightning, while the thunder rolled and rumbled, reduplicated by answering echoes. Fearing to be caught in the grasp of the storm, we hastily inspected some remarkable ruins ascribed to the early Christians of Morocco, and cast a glance on the profound gorge which yawned on our left, and southward opened out into a narrow glen, where some small Berber villages lay in bleak loneliness among their little terraced plots of ground. We then hurried back to Demnat, which we reached at sunset.

We had greater difficulty in getting off on our second and more extended trip into the mountains, but by duly inspiring the somewhat weak Kaid with a sense of the mighty places we filled in the world, and the potent influence we wielded in high quarters, and frightening him with the consequences of his obstructive policy, we were at length permitted to go.

Our way this time lay towards the basin of the Tessaout. At a place called Tasimset we camped amidst the most charming surroundings that any traveller could desire to pitch his tent among. Here we explored an interesting series of artificial caves cut out of tufa on the face of a great precipice and running beneath a splendid cascade. These excavations may have been either habitations of the cave-dwellers who are said to have formerly occupied the mountains, or granaries for corn in more quarrelsome times, or finally, places of sepulture in ancient days.

I myself am inclined to adopt the last explanation of their origin. We discovered nothing to point to their having been used for the other purposes alluded to, while the bones, seemingly human, and the pieces of coarse pottery which strewed the ground, gave colour to the other theory. In such a rocky eyry, amid the spirit sounds which echo among the wind-swept cliffs, and rise from the falling waters of the stream, the old pagan inhabitants would almost instinctively seek a last resting-place.

From Tasimset we were able to penetrate once more to near the central ridge of the Atlas. From a coign of vantage on the top of a mountain range 6000 feet in elevation we looked over a great limestone escarpment forming a sheer precipice several hundreds of feet deep, from the bottom of which sloped away an exceedingly steep talus of *débris* to the bed of the Wad Tessaout two or three thousand feet below.

A little distance to the west, but far beneath, lay the small village of Tafrint, its green terraces, small olive groves, and yellow patches of corn only serving to accentuate the oppressive air of solitude and desolation which brooded over the scene. The river Tessaout, gathering tributary streams from east and west, cut its way by a deep gorge through the numerous escarped minor ranges which ran parallel with the central axis and rose in ever-increasing magnitude till they swept skyward in one grand culminating ridge.

At last the time had arrived for our leaving Demnat, and making our first serious attempt not only to penetrate the lower elevations, but to cross the range itself, and climb to its topmost summits. For this enterprise we chose the route through Glauwa which leads over the mountains to the basin of the Dra on the south side.

Our hopes of being able to do so successfully had risen considerably since the noonday on which we had first found ourselves in front of the Atlas. The rebellious spirit of our men had been broken, though we still had every reason to fear the worst from their underhand treachery. Our first struggles with Moorish officialism had also been encouragingly successful. Better than these, however, were the facts that we had now also secured a Jewish interpreter on whom we could rely, and a Jewish guide, whose knowledge of the mountain routes was excellent.

Thus favourably situated we left Demnat on the 4th of June full of the most sanguine hopes, though still overshadowed by the thought of the disastrous effects that a first failure would have upon all other attempts.

Our men were still in the most complete ignorance of our plans, and imagined we were returning to the city of Morocco when they found themselves travelling back in that direction.

At a sheik's house, called Tezert, an hour from Sidi Rehal, we stopped on the plea of fatigue. Here I made the sheik understand that I was the bearer of a letter to his master, the Kaid of Glauwa, from the Sultan—which was true, in the general sense that I bore one addressed to all the Kaids, but not true in the sense the sheik understood. I did not think it necessary either to show him the document, or to tell him that the various Kaids were instructed not to allow me to enter the mountains.

My stratagem was a complete success. The sheik immediately supplied us with guides, and sent on messengers to his master; and next morning, hardly able to believe in our good luck, we commenced our first crossing of the Atlas.

For a couple of hours our men remained in happy ignorance of our destination; and when at last the truth dawned upon them it was too late, and after an outburst of futile wrath they sullenly submitted to their fate.

Our way at first lay over a series of much-cut-up low hills, composed of white and grey limestone and marls, through which two basalt dykes broke their way. In a couple of hours we entered an even more denuded zone of red friable clays, and speedily reached the glen of the Wad Gadat, up which our course now lay.

As we penetrated deeper and deeper into the heart of the mountains, the glen became more savagely picturesque, the mountains more and more lofty, and but scantily clad with the omnipresent *Callitris* and juniper, evergreen oak and gum cystus. Our route was varied enough in all conscience. At one moment we were winding round great precipices by the merest ribbon of a pathway, overhung by great rocks above, and looking down on a dangerous abyss below; at another we were marching up the bed of the turbulent stream. Here the glen opened slightly out, where friable shales predominated, there narrowed into an impassable gorge or cañon, where more compact sandstones prevailed, causing us to make weary ascents of the steep mountain-sides to continue our way.

It was close upon sunset before we found ourselves at the head of the glen proper, where the Gadat divides and spreads itself over the scarred face of the main axis. We found shelter for the night in the house of the sheik of Zarktan.

Resuming our march with elated feelings, we crossed a series of remarkable wall-like ridges, divided by profound gorges cut out of the red and grey shales which here form the mass of the mountains, and at length descended into the defile of the Asif Adrar-n-Iri—one of the chief feeders of the W. Gadat.

By this portal we pushed our way into the very heart of the great range. At each step made we seemed to be getting deeper and deeper into a land of death and desolation. Not a tree or bush, or even a patch of green grass, was to be seen, except along the immediate banks of the stream. The mountain towered far overhead in precipitous slopes of grey and black shales, or overhung the glen in jagged, frowning precipices of rusty-coloured sandstones. The snow lay in masses on the higher peaks and striated the upper zone, but nothing else varied or softened down the desolate character of the scene. We might, without any stretch of the imagination, have imagined ourselves in the heart of a recently extinct volcano, with the ash-heaps lying about as they fell, and the lava streams as they were congealed.

Yet even amidst all this sterility we found hard-working Berbers wresting a scanty living from the barren soil, and in one of their hamlets named Titula, at the head of the glen, we camped for the night.

Next day we attacked the last heights which lay between us and the southern slopes of the Atlas. Immediately above Titula, a series of quartzite rocks bends round and runs at right angles to the line of the glen, and this it was which had resisted all the denuding forces of nature, and stood as a barrier between the basin of the W. Gadat and the valley of Teluet on the other side.

In a couple of hours' hard climbing we reached the top of the Tizi-n-Teluet, at an elevation of 8300 feet. On the east and west the mountains still rose from 4000 to 5000 feet in frowning masses above us, but that we thought little of, for we could not only command a view down through the gorge of the Gadat to the plain of Morocco and the peaks of Rahamna, but to the south our eyes swept over the valley of Teluet and the broken plateau region beyond, through which the tributaries of the Wad Dra cut their way. Nothing, however, could have been more disappointing than the aspect of this promised land. We looked in vain for the Anti-Atlas which we had been taught to expect. No such feature met our eager gaze. A mournful and monotonous expanse of slightly broken plateau, unrelieved by green forest, or varied by mountain heights, was what stretched before us far into the haze of distance.

Before the sun had reached its zenith we were riding across the green valley of Teluet to the castle of the powerful Kaid of Glauwa—one of the most imposing buildings we ever saw in Morocco. Our reception was princely in the extreme, and would have been gratifying, but that we knew it was accorded under a false impression.

The Kaid's face was an interesting study when he read the Sultan's

letter, but our fears were somewhat relieved when we saw that, like a pious Moslem, he recognised the hand of Providence. The shrug of his shoulders and uplifted eyebrows plainly said, "Kismet! It is written, Who can avoid God's decrees?"

At Teluet, where we remained for several days, we had an interesting insight into mountain life and ways. We saw here, as in the plains, the dreadful pulverising action of the monstrous machinery of Moorish misgovernment. Even more fascinating was it to study the Jew of the mountains. Nowhere, perhaps, is the astounding persistency of type and the tenacity of race more remarkably shown than in these Jews. For unknown centuries they have lived in the Atlas glens under the most oppressive conditions, little better than serfs or slaves to the so-called "protectors" to whom they have to attach themselves. Hated and despised, too, as never were mortal men before, yet they have only clung all the more tenaciously to their religion and customs, believed in themselves all the more firmly as the chosen ones of God, and lost in no one particular the physical characteristics of the race.

In other ways we occupied ourselves profitably. We were able to make an ascent of one of the peaks of the central axis, and also the plateau to the south. On a third excursion we explored a series of caves excavated in a clay cliff, which had more the aspect of having been used as store-houses or granaries than those of Tasimset.

On a fourth excursion, which I attempted clandestinely, accompanied only by a Jew, I was less successful. We were driven back by infuriated mountaineers, and narrowly escaped with our lives. Our hopes of being able to penetrate further south into the basin of the Dra, or of passing westward through Tifnut, and along the unexplored southern aspect of the Atlas, were doomed to disappointment.

Bravado was of no use this time. The Kaid threatened to send us back in chains, or put us in prison till we came to our senses. On the other hand, it was only too clear that we could not get our men to budge one step, for to their treachery our stoppage was undoubtedly due, and with the Kaid and his people to back them up they were the masters of the situation. Under these circumstances there was nothing for it but to go back as we had come.

We commenced our return to the plains on the 18th of June, and in two severe marches reached Iminzet, at the mouth of the W. Misfiwa glen. We would have attempted a mountain trip from this part, but that we deemed it advisable to obliterate our traces in a manner, and also to throw our men off the scent. For this purpose we made a forced march of fourteen hours to the Kasbah of Gurguri, reaching Amsmiz early next morning. Here we were able to throw dust in the eyes of the Kalifa, or lieutenant of the Governor (who was happily absent), and to hoodwink our treacherous men. On the 24th of June, the latter, very much to their surprise, found themselves on the way towards the glen of the Wad Amsmiz.

As at Tezert they had no opportunity to try their villainous underhand tactics, and they dared not oppose us openly, so there was nothing for them but to bide their time—as they had done at Glauwa. This we

knew only too well, and we despaired of getting beyond the first mountain governor.

On this occasion our ostensible goal was Gindafy, in the heart of the range. Our way lay up the desolate glen of the Wad Amsmiz. By a most terribly difficult and rarely used path, we reached the top of the mountain at a pass called Tizi-Nemiri, 10,000 feet in elevation.

To our surprise and annoyance, we found that the main axis was cleft into two by a deep narrow glen running parallel with the range, and formed by the head-waters of the Wad Nyfis. This glen proved to be Gindafy, though we had been led to believe that, like Teluet, it lay on the southern slope. The mountain scenery displayed around the Tizi-Nemiri differed widely from that which had so far come under our notice.

We looked in vain for the table-topped heights—the escarped ridges, the straight lines of bedding, the rich mottling of red and purple shales, and their relieving greens of tree and bush which had characterised the mountains of Glauwa and Demnat. Here, instead, was a much more denuded region, with sharp peaks and ridges, jagged and rugged outlines and slopes, covered with grey slaty *débris*. The explanation lay in the geological formation. We were now in a metamorphic area, where friable clay-slates, with stiffening masses of greywacke, and crystalline limestones, replaced the grey and white limestones, and the red and purple shales and sandstones of the cretaceous area further east. Though wanting in some of the effects, and specially in the rich colouring, the mountain scenery along this zone was more effective and picturesque. What it wanted in massiveness, it made up by the sharpness of its fantastic peaks, the serrated outlines of its ridges, the depth of its glens, and the generally more varied character of its outlines.

From the pass of Nemiri, the descent to the deep glen of the Nyfis was one of great difficulty and danger. So steep was the path that the men had to cling to the tails of such of our mules as had small loads to carry, in order to give them back weight and act as a brake on their movements. As it was, one mule went over the side, and had a most marvellous escape from death a couple of thousand feet below. But Moorish mules are like cats, and in some way or other ours contrived to stop its headlong progress, till rescue came.

At Gindafy we had a very inhospitable reception from the Kaid, and from it we knew at once we would never get further. We were happily able to penetrate one remarkable cañon, which cut into the southern section of the range, before our men got at the already suspicious Governor. We were then detained prisoners in our tents, and were glad at length to return to Amsmiz by way of the glen of the Wad Nyfis and the Tizi-n-Girimt.

It was my policy to take both my men and the natives by surprise, and, seeing an opportunity for a new adventure, I struck while it was hot, and before any one had time for reflection. On this occasion, determined not to be thwarted by my men, I took only three, two of whom I could depend upon fairly well. Thus scantily attended, and with one native as a guide, I left Amsmiz on the 6th July, penetrated the mountain fastnesses of the Asif-el-Mel, and crossed the mountains once more by a new

pass into a district called Ogdimt, at the very head of the Wad Nyfis. Here we were in a part of the Atlas where the Berbers still retained their independence, and we had a very anxious time among them, as they not only regarded me with hatred as an enemy of the faith, but with suspicion as a possible spy of the Government.

On the following morning I started with only one attendant to ascend at all hazards a high snow-streaked mass which formed the head of the glen. We were chased up the mountain by some natives, and I had not only a very narrow escape of being shot, but of doing myself grave harm by the frightful struggle I had to keep ahead of my pursuers. Such a race becomes no joke when an elevation of 10,000 feet is passed. Breathing, then, becomes difficult; the heart palpitates with painful force and rapidity, and the head throbs. Thanks, however, to my mountain training in Scotland, I not only kept ahead of my pursuers, but safely reached the top of the mountain at a height of 12,734 ft.,—1500 higher than had ever been attained before in the Atlas.

I would like to sketch to you the splendid prospect of peak and gorge, of grove and field-mottled plain, of distant mountain masses, of rivers winding seaward, of Berber villages clustering againstthe mountain-sides, and step-like terraces, which spread themselves out beneath me like a map; but such sketching is impossible at present, and so I pass on.

On my return to camp it was abundantly clear to me that Ogdimt was no safe centre of exploration, and before dawn on the following morning we had left it behind us, and were on our way by a new route back to Amsmiz.

On the 13th of July we re-entered the city of Morocco. We here spent six weeks studying the place and people, and waiting for the cooling down of the stifling heats of the Moorish summer. The monotony of our residence in the capital was varied, on the occasion of a great religious festival, by the unpleasantly manifested desire of a mob of people to make their entrance to paradise sure by stoning us to death. Though knocked black and blue, and considerably bruised, we escaped without serious damage.

On the 27th of August we resumed once more our attempts to unveil the secrets of the Atlas heights and fastnesses. In the glen of the Wad Urika, where we least expected it, we found not only a Kaid who was too sharp for us, but mountaineers who drove us back with curses and threats.

Nothing daunted, we determined to try and outflank them. For this purpose we passed on to the Wad Reraya. Following the river to Asni, we there were more fortunate in overcoming the usual obstruction of the sheiks, and succeeded in penetrating the eastern of the two glens into which that of the Reraya splits.

This was the most striking in its frowning desolation of all the valleys we had yet penetrated. The geological formation clearly showed that we had reached the oldest part of the range, the very focus of the forces which had elevated the mountains.

At the head of the glen we commenced the ascent of the chain, and were so fortunate as to reach a height of 13,151 ft. without mishap. Here we found ourselves, after all, at the head of the Wad Urika, which we

had failed to reach by its own glen. Chiefly, however, were we struck by an imposing mass of mountain which rose in kingly majesty far above all the bewildering assemblage of snow-streaked peaks, sharp serrated ridges, barren slopes and slaty *débris*, and ribbed and rugged projecting igneous rocks which spread around us. This was the Tizi-n-Tamjurt, undoubtedly the highest elevation in the Atlas.

From Asni we once more passed to Amsmiz, and thence westward along the base of the mountains to Imintanut. Here we carried into execution our cherished project of crossing into Sus, not, however, without a last grand battle with those of our men who had from first to last been thorns in our flesh. Happily they were now two or three months in arrears of wages, and we could therefore afford to smile at their excitable behaviour and futile threats. In this enterprise, however, there was an additional danger. A civil war had broken out over the selection of a governor for the province of Mtuga, and for the time being all the ordinary machinery of the government had broken down. This naturally increased our danger tenfold, as there was then nothing to restrain the pious Moslem from sending such Kaffirs as ourselves to Gehenna. We had, however, heard so much about what was written and the unalterable will of Allah, that we had become unconsciously influenced with the fatalist doctrines of El Islam, so, to all representations of the danger we ran, we simply shrugged our shoulders and asked, "Who can avoid the decrees of Allah?"

It was under these hazardous conditions that we left Imintanut on the 9th of September. In three hours we reached the watershed of the range at an elevation of 4700 feet. From this point we followed a stream flowing through a broad shallow valley to the W. Sus. At each hour we felt more and more assured that we were skirting the end of the Atlas as a range, and that therefore it did not extend to the Atlantic, unless the plateau of Mtuga and Haha could, by a stretch of the imagination, be considered as a part of the chain.

At sunset we camped under the Ida Uziki Mountains, all on the alert for an expected night attack. Next day we skirted the tail end of the range to the Asif Ig, whose gorge forms the dividing line between the Atlas and the plateau further west.

On reaching the plain of Sus on the following day, we found ourselves in an even more dangerous situation than that we had just escaped from in Mtuga. The dreaded Howara Arabs were scouring the country in all directions, and had that very morning despoiled a caravan only a few miles from where we were camped. We found refuge for the night in the Kasbah of the Kaid of Msgina, which was crowded with soldiers in hourly expectation of an attack. Next day, fearing to be shut up, we ran the risk of capture, and fled to Agadir, which we reached safely on the 12th of September. Thence we skirted the coast to Mogador, where we changed our men, and then, under less irritating conditions, we resumed our way to Casablanca. Here I was recalled home, while my friend, Mr. Crichton Brown, continued his way to Tangier by way of Mequinez and Fez.

LAPLAND AND SIBERIA BY WAY OF THE ARCTIC SEA.

(Read at Meetings of the Society, Dundee and Aberdeen, February 1889.)

By Philip Sewell.

On the 19th of last July there left Newcastle a vessel of "whaler" build, the S.S. *Labrador,* one that often in the service of the Hudson's Bay Company had visited the Arctic seas. Her crew had been picked from among those men whom Lieutenant Greely has spoken of as the "hardiest and most fearless navigators of the present day—Scottish whalers." She was under the command of Captain Wiggins, her destination being Siberia.

The voyage was the fifth in a series undertaken by Captain Wiggins, aided latterly by the *Phœnix Company,* with the object again to carry a cargo of manufactured goods into the heart of Siberia, by steaming to the mouth of the great central river, the Yenisei, and there exchanging cargoes with the company's river steamer the *Phœnix.*

Unfortunately this end was not attained; when at Vardö, the port immediately to the east of the North Cape, the *Labrador,* when on the point of continuing her journey, was stopped by the news, telegraphed from Siberia, that the *Phœnix* was aground. It was supposed that she would not be floated until the floods of the succeeding year, so that the directors of the company had before them but the alternatives—either to recall the *Labrador* for this season, or hastily to send out to her a steamer suitable for the river traffic.

They chose the latter; and, briefly to finish the narrative of last year's expedition, the steamer sent out from Glasgow detained the *Labrador* at Vardö for so long a time, that subsequent delays, consequent upon the separation of the two steamers in a storm, and finally the return of her companion to Vardö, made it useless for the *Labrador* to push forward to the river mouth. We were then, of course, ignorant of the fact, learnt only on our return to England, that the *Phœnix* had, after all, proceeded down the river to the rendezvous; this news did not, naturally, tend to lessen the disappointment felt by all.

It is abundantly evident, however, that the company, though seriously thwarted, has definitely advanced a step in this last expedition. Wiggins has again demonstrated his route, for a vessel adapted to navigation among ice, and this in the worst season known for years, or, indeed, the worst among those of which there is definite record.

It is, to my mind, a fact of equal importance with this, that the captain of the *Phœnix* has taken his steamer—one not by any means best adapted to the difficult river navigation—not only to the river mouth (despite the slight accident, so serious, however, in its results), but he has taken her back again to winter quarters at Yeneseisk, a town more than a thousand miles inland. Wiggins, although he did not proceed actually across the Kara Sea, yet rounded the pack ice lying to the south-west. Shipwrecked walrus-hunters taken on board told us that they

had sailed as far as to 75° N., and found open water extending beyond loose pack of which we had seen the eastern limits.

The remarkable interest which this country now awakens has perhaps, by this time, prepared us to expect great things of a region that but a few years ago was regarded as the dismal home of exile—a land the most dreary upon earth, over which a continuous winter was supposed to hold sway.

We receive now from all sides—most recently from the brilliant series of letters by Kennan in the *Century Magazine*—accounts of the possible productiveness of this country; and along with bright forecasts as to its future, we have statements as to its present actual wealth in the grain-yielding districts and in the mines. Wiggins tells of the comparative civilisation of the gold-mine owners, with their almost palatial houses, where may be seen choice furniture from London or Paris; he surprises us when stating that the telephone and the electric light are not unknown, whilst yet more remarkable is it to picture with Kennan the magnificent public buildings—the universities and the libraries in some of the more important southern towns.

Our most recent knowledge shows that, though enduring, in certain areas well to the east, the greatest degree of cold known on the face of the earth, yet in summer it also enjoys an extreme warmth.

Although to the north there extends a vast "tundra" region, uninhabitable save along the river banks and the coast, and apparently useless for any purpose whatsoever, yet to the south the land is spread out in great fertile plains, watered by a gigantic net-work of noble rivers. If we may believe the many reports as to its fertility, it holds out a possible wealth in its virgin soils and stores of minerals surpassing in degree the wealth of Manitoba, or of the Western States of America, just as the country surpasses such in extent.

Although at the present time its population is totally inadequate for the right development of even a small fraction of its resources, there are many who even now have realised large fortunes, settling down along the river highways, and it is to be supposed that—thanks to the system of exile—the number of these is continually increasing. Further, a large number of free emigrants from Russia are yearly adding to the population.

It remains to be seen how Russia intends best to develop this part of her dominions. At present it is not alone this most enterprising British Company, but certain no less persevering Russian merchants, who would stimulate the interest in Siberia and open up fresh fields for commerce.

Necessarily, we shall turn our attention this evening chiefly to the endeavours made in the north of Siberia, but we must not overlook the remarkable facts told us regarding the vast herds of cattle, and the vast exports of grain, butter, potatoes, etc., from the Tobolsk provinces to Constantinople and the west. Concerning ourselves, however, with the assiduous work of the Russians, we find on the Yenisei and the Obi those who would make use of the great northward-flowing rivers to bring some of the produce to the more populous centres in the west, and thus set up a demand as shall tend effectively to benefit their own land.

M. Sibiriakoff, the successful promoter of the Northern Trans-Ural roadway, is one whose name should be mentioned first among those who, in Russia, desire to make use of these rivers.

He is especially interesting to us, in connection with the work of Wiggins, inasmuch as, before the *Phœnix Company* came to aid that dauntless navigator, he had given him £1000 towards the expenses of his voyage in the *Thames*. This was his second voyage into the Kara Sea, the first in which he actually ascended the Yenisei.

Sibiriakoff has already a couple of excellently constructed steamers which trade with towns on the Obi, but he is far from being so sanguine as to the use to be made of these, as is Wiggins. He looks to the completion of his roadway between the Obi and the Petchora at once to obviate the difficulties of navigation in the Kara Sea, and, at the same time, to allow of goods being brought down the river to the open sea north of Russia, where, except during the winter, ice is never met with. But Sibiriakoff is not a navigator as is Nordenskiöld, who, from the first, has favoured the Kara Sea route, nor as is Wiggins, who now has demonstrated its feasibility beyond disproof.

Another proposal, which I think emanated from the Russians, is to cut a canal through the foot of the Samoyed peninsula, thus lessening the distance to the Obi by close upon a thousand miles. This, Wiggins has regarded with extreme favour, and when, last year, Mr. Victor Morier left us at the Yugor Straits for an overland journey to St. Petersburg, Wiggins persuaded him to travel along the Kara Sea shores that he might inspect as to the land through which such a canal would be constructed.

There is also M. Sideroff, a wealthy merchant on the Yenisei, who owns among other things, graphite mines, and is naturally anxious to see trade with Europe established. It was as his agent that Captain Svanberg sailed from the Yenisei to St. Petersburg in a small craft that had been constructed for Wiggins and Seebohm, and in which, had his sailors but had pluck enough to have accompanied him, the former hoped to have returned to England.

Mr. H. N. Sulivan, the indefatigable director of the *Phœnix Company*, tells me that Sideroff is now dead, and that in addition to Sibiriakoff's undertaking, a railway is being constructed from the Obi through North Russia.

Such, then, are the efforts now in progress, to develop a part of the industries of this country, whilst the important fact that the Russian Government has granted to the *Phœnix Company* for five years certain trade concessions, is an unmistakable sign of her liberal willingness to render aid, as well as to receive it from the enterprise of our own countrymen.

This work of Wiggins and of the *Phœnix Company* is, however, not so new as at first we might imagine it to be. True, it is a scheme at once more definite and successful than any ever before put forward with the purpose to trade with the north-east, but these most interesting voyages, dreamed of forty years ago by Wiggins, when engaged in the Archangel trade, form but another chapter in a long record of such, which, culminating as regards the actual North-East Passage in Nordenskiöld's brilliantly successful voyage in the *Vega*, have their origin in those more or less

disastrous voyages, begun more than three centuries ago by the earliest of the "Merchant Adventurers."

It was in 1553, the year before the birth of Raleigh, that the first Arctic explorers, Sir Hugh Willoughby and Richard Chancelor, left London in their three small vessels, rounded the North Cape, and proceeded eastward, essaying to reach China and Japan. Sebastian Cabot had given his best counsel to them, the court and people had encouraged them, but they went to a dismal fate.

The first from our shores to brave an Arctic winter, ignorant totally of its severity, ignorant of the barren shores of those seas, Willoughby and his crews perished; Chancelor, however, escaped to the south, and discovered Archangel.

It is worthy of remark that this voyage to the East thus stands first in the long series of those to the Arctic regions—it was not until thirty years later that Davis re-discovered Greenland, and "opened up the Smith Sound route to the Pole."

After this unfortunate venture, other of our bold sea-captains, Hudson among them, attempt the passage. Nor are the Dutch behindhand in the search.

All set out confident that they would reach the Indian Seas—none push further than to Novaya Zemlya—some meeting with ice (as we did this year) off its south coast, others seeing before them open water to the Siberian northland. These voyages continue for more than a century, until, with the failure of Wood, all thought of further exploration is given up, and it is left to the Russians, in sleigh-journeys along the coast, to map out the coast-line of Asia, and to trade, as to-day they trade, in furs and skins, from the Petchora and the rivers further to the east.

But we may view these voyages of Wiggins, not alone in their relation to the trade and development of Siberia, but as attracting our attention to the Arctic regions, a part of the world that has always aroused interest in this country, especially, in these towns (of Aberdeen and Dundee), where for some years our whaling industry has been centred.

In this country, naturally enough, having before our minds that noble array of names from Davis and Baffin to Franklin and M'Clintock, our thoughts turn, on mention of the Arctic regions, to the Greenland seas. Yet, thanks to several public and private expeditions in recent years to the Polar regions east of us, we may now make comparison between these and the better-known regions to the west, where, indeed, some essential differences have to be taken notice of.

The feature of prime importance is, of course, the Gulf Stream, which, as a current of warm water, flows past the North Cape to the uninhabited[1]

[1] The Russians attempted to settle a colony of Samoyeds upon Novaya Zemlya, but the attempt was not successful; nor is this to be wondered at when, one winter, the steamer sent with stores did not approach the coast because of a barrier fringe of ice. There has, I think, been on the south island a Russian scientific camp for the greater part of the year, whilst it is purposed to stay for several years continuously. On Spitzbergen, this winter, Lieutenant Pike from London, and a party of Norwegian sealers are braving the winter alone, unless, indeed, the crew of a sealer from Vardo, which has not returned to that port, are shipwrecked thereabouts.

islands of Spitzbergen and Novaya Zemlya. This it is which makes Lapland as habitable in the winter as New York or Chicago, as regards the temperature—and which, in the summer, gives to it and Novaya Zemlya a climate so mild and genial that, with some slight exaggeration, the old Dutch explorers described it as like that of their own country in the "dog days."

However, it is not in summer, but in winter, that the temperature experienced in these regions is so much milder than their high latitude would suggest. In summer, lines of equal temperature run fairly parallel to the lines of latitude; in winter, on the contrary, they run more parallel with those of longitude, almost from north to south in Scandinavia and between the North Cape and Novaya Zemlya; so also to the east of Novaya Zemlya, until indeed the pole of greatest cold is reached in the valley of the Lena.

In the beginning of winter when Polar seas are yet open, the effect of this is abundantly seen, for while it is probable that the temperatures of the water in the Greenland seas is never more than one or two degrees above the freezing point, in the Kara Straits it may be close upon, perhaps above, 40° F., even at the end of September. Wiggins found the surface temperature at 50° in the Kara Straits when in 1874 he was returning towards the end of August; last year, with ice in the neighbourhood, it was 37° on the 29th of September. Earlier we found so much drift-ice in the straits that, as was to be expected, the temperature of the contiguous surface water was commonly down to the freezing point. But this was not always the case: with a wind setting up a strong current through the straits from the west, even while amongst the ice, my thermometers one day showed a temperature of 38° F. and 39° F.

It is abundantly evident that although the main current which passes the North Cape may fail to enter that part of the sea SW. of Novaya Zemlya, yet it has a considerable effect in raising the temperature thereabouts. Nordenskiöld detected its presence much further to the north, whilst Wiggins is confident that the high temperatures he observed were due to its influence chiefly.

Last year we kept as careful records of the temperatures every four hours as was possible. They showed a gradual lessening of the water temperature as we proceeded eastward from the Cape; thus, off Kolgnieve Island, 43·5° F. was 3° less than the temperature recorded at Vardö —this in the beginning of September. There was, of course, a very sudden fall in temperature as, proceeding further eastward, we neared the loose pack.

The water temperature off the Loffodens was some 4° F. colder on our return in October than when we had passed in July. Whilst at Vardö, experiencing a characteristically even climate throughout the almost continuous day in August, the temperature of the air was never above 56° F; the lowest recorded was 45° F. During our stay in September at the Yugor Straits the limits were from 41° F. to 28·5° F., where winter gave ample signs of its approach in a heavy covering of snow; the days had by then very considerably shortened. Both there and in Lapland the aurora was on several occasions conspicuous. Of interest, as

showing comparison between the climate of Lapland and that of the British Isles, are the recorded early October temperatures, 26° F. to 34° F. in the former country, as compared with temperatures in the shade of from 29° to 65° F. late in the same month in the north of England.

But, omitting further comparison between climatal conditions in these places with those in our own country, it is essential to recognise that the low-lying land of those regions conduces materially to a warmer climate, for unlike the glacier-covered slopes of Greenland, the north of Siberia and the southern islands, at least, of the Novaya Zemlya group, lose their winter's mantle of snow before the summer is well advanced.

There is poured into the sea a vast volume of comparatively warm water which Nordenskiöld judges would, with the heat of the sun, be sufficient to melt any ice left as drift in the Kara Sea: this ice, from the absence of glaciers, being limited to floes and hummocks. Of course it will depend largely on the time of year in which these are seen—but their size in September was not in any case very large. Floes of 200 by 400 feet were uncommon, although in the Kara Sea pack we saw some much larger. The pieces of drift were smaller about the Straits, where, doubtless, they had become much broken up. Fifteen to twenty feet would be the maximum thickness of any ice that we met with, although some of it was that of the preceding year.

On the surface of the larger floes were ponds showing the deep ultramarine colour of the ice; the water of which was perfectly fresh. This ice formed no obstacle to the progress of the *Labrador*, which, when slowly steaming, would send the floes to one side of its bow, or cause them to break in pieces, but it very seriously hampers vessels without steam, and indeed proved destructive to four of the slighter sloops of the Norwegian walrus fleet this year. It was the impatience of these men that proved their ruin. When on their homeward course from the open water of the north and north-east of the Kara Sea, they came where, in the south-west, the drift-ice is packed loosely against Waigat's Island and the east coast of Novaya Zemlya. Having had a bad season, and fearful lest the ice should cut them off, they ventured, before a northerly wind, between this drifted pack and the coast to the south. It only needed that the wind should increase, or shift a point or two to the north, and it was evident the ice must be drifted down upon them. They hope to gain the entrance of the Yugor Straits, but the ice is upon them before it can be reached—some are crushed, and the men escape only in open boats—others are driven on shore. When, two weeks after this, Wiggins steamed into the Kara Sea and found a passage twenty miles in breadth where these men had been caught, he showed that had they but waited behind the ice they might have sailed out in safety and with the greatest ease. It is unusual for these men to lose their ships; at times they sail round Novaya Zemlya—generally they follow up the ice to the north-east, entering the Kara Sea in June and August; Captain Jansen pushed this year to 75°, where there was, as usual, open water.

This year they were evidently surprised that so much ice remained in September. Even Nordenskiöld, from his own experience, and from

the statement of the walrus-hunters, considered it probable that every year the ice in the Kara Sea would be entirely melted. Wiggins in 1887 met with no ice, nor indeed has he ever met with it, when on his homeward voyages, however abundant it might have been earlier.

A glance at the map will show how, with persistent northerly and north-east winds, the ice in the south of the sea can never be moved away. It may be forced, in comparatively slight amount, through the Straits to the west, but it cannot disappear in this way. On the other hand, if winds from the south are general in the early summer months, they drift this mass into the currents of the Obi and Yenisei, and so cause it to disappear entirely. It may be usually the case that, if not so drifted away to the north, it is entirely melted, but it is evident that this year, the late season (of which we heard when at Vardö) and the resulting unusual thickness of the ice-floes, caused the pack to persist in so marked a manner.

These facts allow of much certainty in judging as to the prevalence of ice in the southern latitudes of these Arctic seas; they are of importance, in relation to sealing and trade—not, however, of so much interest to the more adventurous explorers who may push further to the north.

Before proceeding to the purely descriptive part of my lecture, when I hope my photographs in the lantern will enable you to obtain a conception of the country and of the ice-floes better than can be given in words, I would speak of that great industry of the north of Norway, of which we saw not a little—the Fin-whaling.

It ranks second in importance to the fishing at Vardö, for which in the early part of the year as many as 5000 to 6000 fishermen come to the little port, which has an ordinary population of 1500. But the fishing industry is carried on in much the same manner as elsewhere, save for the piles of cod-fish heads stored for manure, and the great vats filled with decomposing livers, a stage in the production of a coarse train-oil. The whaling, however, is unique in method, differing essentially from that of the Davis' Straits, to which we are accustomed. The species of whale pursued is chiefly the Rorqual, although Blue Whales and Humpbacks swell the total. Though not approaching in value the Greenland whale either as regards the yield from the blubber or the quantity of *baleen*, they are captured more economically, and, in addition, the carcase is manufactured into guano—a source of income denied to the western whalers.

The pursuit is with active little steamers, capable of making twelve knots per hour, and so constructed that on directions given by the look-out in the "crow's nest," they may be turned as rapidly as desired.

We saw several of these active little steamers, which in July and August are especially busy. Just off the North Cape one passed near to us in full pursuit, turning here and there in a swift confusing chase. In her bow was the large harpoon-gun, capable of throwing the explosive harpoon to an effective distance of perhaps thirty yards. This gun is moved easily on a swivel, and may be fired as readily as a pistol. The harpoon, about four feet in length, is attached, not to a line, but to a veritable cable. Having entered the body of a whale, an explosion set

up by the impact, usually kills the animal at once, and at the same time throws out from the harpoon shaft three stout iron barbs, which fix the instrument as an anchor in the victim, and allow it to be towed in safety to the nearest boiling station. The distance to the station may at times be great, and occasionally the whale has to be abandoned; such an one, after floating about for weeks, was brought to Vardö when we were there, and a fearful sight it was. Its carcase and remaining blubber yielded oil in some quantity.

Some idea of the size and nature of the explosive harpoon may be gained from the statistics kindly placed at my disposal by Mr. Heneage Cocks, M.A., whom we met at Vardö, and who is so well known as an authority on this subject.[1] "Without the shell it weighs 123 lbs., its cost is about £4, 10s. as it leaves the blacksmith, over £5, 10s. when ready for use. The required charge is over half a pound. That of the shell over three-quarters of a pound."

We visited one of the boiling stations, and saw the immense animals stranded between tide marks, the blubber cut off in huge pieces and dragged up an incline plane to the vats. Then after the jaws have been cut off, the carcase or "krang" is, perhaps at the next tide, towed away to the nearest factory, where, in the short space of thirty-six hours, it may be reduced to guano.

In this industry, which commenced less than a score of years ago, there are to-day over a dozen companies engaged, with thirty-two steamers, at twelve stations.

They are, however, suffering from the competition thus established. About this we heard serious complaints when at Vardö, but the valuable tables of Mr. Cocks show more definitely the state of the depression. He mentions that in 1885 there were obtained 1398 whales; in 1886, 954; and in the succeeding year, 854.

The fishermen also complain that the whalers have injured their trade, driving away from their coasts some of the vast shoals which there exist. That such a result will be discovered, as that the whalers are seriously responsible for the fewer hauls of fish, is unlikely, but it is more than probable that the system of hunting the whale so close in to the coast (necessitated by the position of the boiling stations) materially lessens the numbers of the latter.

On our outward voyage we saw great schools of Rorquals and other *Cetacea*, at a distance from land to the south of the Loffodens, sighting them first about the sixty-eighth parallel, when perhaps a couple of hundred miles from the coast. We saw them in great numbers after that, yet, although we noticed quantities of their probable food when near to Novaya Zemlya, only once to the east of Vardö did we see the animal itself. This was perhaps due to the considerable storm we experienced at the time.

Although, perhaps, not so daring a life as that of the walrus-hunters, and certainly not comparable, in this respect, to the life of our own whalers, there are peculiar dangers to be encountered by the Norwegian

[1] *Zoologist*, 1887.

whaling fleet about their difficult coast, whilst Mr. Cocks tells us that the whales, of an especially active species, have not infrequently charged at and seriously damaged steamers and boats.

The two countries Lapland and Siberia, as seen respectively from the port of Vardö, and from the anchorage at the Yugor Straits, offered many contrasts. As seen from the sea, Lapland immediately to the east of the North Cape is not mountainous, appearing almost low in comparison with the noble mountain ranges of the Loffodens, which we had seen extending in one grand panorama of snow-topped summits, as, towards the end of July, we steamed past them. Again, too, on our return voyage we steamed among the noble fiords of this island range; where in places, so steeply does the rocky wall pass into the water, and so deep is it, that "anchorage" is impossible, and instead the vessel is made fast by hawsers to rings placed in the face of the cliff! Just as the mountains of the Loffodens give place to the high cliffs of the North Cape and the Nordkyne, so, as you pass further east beyond Vardö, the lower land is again superseded by the mountainous country of the Murman shore. This higher coast of Russian Finmark may be seen from Vardö, as a blue line of mountains, forty miles away to the SE.

When, however, that part of Siberia, north of the Urals, is reached, where the mainland is separated from Waigat's Island by the narrow Yugor Straits, the country, as seen from the deck, is low-lying in the extreme. The cliffs are commonly not more than 20 to 30 feet high, although they are perhaps 100 to 150 feet at the eastern entrance to the Straits, where the low hills—the northernmost spurs of the Urals—pass into Waigat's Island. These hills, though in reality most insignificant, are an especial feature in those parts, where bogs and shallow pools, amid a most monotonous vegetation, of course without trees or shrubs, extend to east and west. However, neither the land of Waigat's Island, nor of the mainland, appeared so barren as we had expected. When seen from the ship's deck it was brown with autumn colour, and no doubt in mid-summer had been vividly green with its covering of coarse grasses and sedges. Yet once we stepped on shore, we missed the turf of our own meadows, or even such as we had been accustomed to on the island of Vardö—the grasses and characteristically Arctic plants were but sparsely scattered over the stiff bluish clay, formed from the shales which most especially occur thereabouts.

The land was not, however, "frozen a few inches below the surface," as is the case in the higher lands east of the Yenisei, but whenever the traveller might attempt to cross the boggy peat of the "tundra," he would find that in that part of the world, too, he was able to sink substantially below the surface.

On land, animal life was very scarce; we noticed traces of the lemming, saw several foxes and a stoat, snowy owls, and a few small birds about the tundra; whilst passing to the south were occasional flights of geese and ducks, and about the village were many skins of bears.

Also sea fowl were nearly absent as compared with the great numbers we had seen about the North Cape; the shoals of fish that off the coast

of Lapland had in places darkened the water with their presence, did not visit these colder seas, the only kind seen during the time of our stay there was a species of stickleback, which was obtained in my tow-net over the ship's side, along with many *Crustacea*. Among the shells and sea-weed on the beach were the eggs of the cod, drifted there doubtless from some distance, as evidently the surface currents bring large quantities of drift-wood, planks of ships, and such signs of different latitudes to those shores. We heard, however, that in the summer the Kara River is well stocked with salmon and other fish.

Seals, a few walruses, and the remains of a grampus on the beach, were the only signs of the larger animal life of those waters.

It is not the place here to make mention of the exceedingly interesting Arctic flora, showing much the same plants as occur in Lapland and in Greenland; among these are many of the rarities of our Scottish mountain tops.[1]

As to the people and their dwellings in the two countries, there is, of course, all the difference in the world. Lapland is now in its towns as much civilised as are the southern parts of Norway. Except at certain places here and there along the coast, the Laplander is not conspicuous. Three generations, and more, ago, Lapland (or Finmark) was the land of exile from Denmark; to-day the descendants of these exiles are the merchants who have attracted others to the country, and who now derive considerable wealth from the fisheries. The Laps, with their strange garb, their coloured "mortar-board" hats and their reindeer garments, appear out of place among the civilians and conventionally civilised Norwegian officials; their curious and light skiffs contrast oddly with mail steamers and the concrete piers of the port of Vardö. This place, Abercrombie, in his most recent work, characterises as saturated with uncomfortable grease, which indeed we found the prevailing feature.

With it the little village at the Yugor Straits has one point in common—both possess churches! It is most strange to find, among the few log huts of the company of Russian merchants, at the latter place, a new and trim little church, given to the village with a large and ugly storehouse, by the merchant Sibiriakoff. The Samoyeds have given up their idols, carved out of the abundant drift-wood; they are clothed in the same way as when the first travellers described them as having "the bodies of oxen and the feet of birds," so strange had the reindeer clothing appeared to them. Their fantastic, open graves, covered with bones and relics of the chase, are less tended than formerly, though yet to be seen along the coast, whilst near to the village was an ordinary burial-ground, with the characteristic sacred crosses of the Russians at the head of each raised grave.

The Samoyed men had an oily joviality about them; though of small stature they looked a strong race of hunters; their women were more evidently phlegmatic—and were seen sewing pieces of reindeer skin together into the picturesque and comfortable garments needed for the winter, or perhaps they might be seen engaged as the hewers of wood

[1] See *Trans. Royal Botanical Society of Edinburgh*, 1889.

and drawers of water. To their children and their dogs these people are most affectionate,—so, at least, we hear.

The curious tents, covered in winter with reindeer skin, or, in summer, with birch bark, are picturesque in the extreme, though dark and dismal in their interiors. Perhaps there were some dozen of these at this village, which is quite the most important settlement thereabouts. Through it the natives pass to lead their herds to the pasturage of Waigat's Island when winter is about over. A wealthy native may own several hundreds of these useful animals, which supply him with all the necessities as well as the comforts of life; lately, among these herds the spread of a species of cholera has worked terrible havoc.

Doubtless, most of the Samoyeds migrate southward in the early winter, leading their herds to better feeding-grounds nearer the Urals, although some remain throughout the year at the village, and with them a subordinate priest to tend the church. The priest himself left by one of Sibiriakoff's steamers for the Petchora, whither the Russians also migrate for the winter. He had actually taken his daughter with him to that isolated spot, and when the ice appeared at the time of our visit, was most fearful lest it might hold him a prisoner there throughout the long darkness. It, however, was only blown about by surface currents, nor would the passage be blocked until a full month after we had left the straits.

Yet the darkening days and the, to us, so early snow gave signs of the approaching dominance of all-powerful frost and darkness, before which such of the inhabitants and animals as could were thus migrating. We, with the Norse crews, to whom Wiggins so kindly gave a passage home, were not the less pleased to retreat before this swiftly coming and overwhelming Arctic winter; having, however, left on shore one of our number, Mr. Victor Morier, and two of the ship's company, to face the difficulties of a homeward land journey, and to migrate southward with the Samoyeds by way of the Valley of the Obi, and so to Petersburg, where, after a remarkable journey, they arrived in January.

THE ESKIMO TRIBES.[1]

Dr. Henry Rink, the leading authority on the Eskimo tribes, who has been the foremost upholder of their American origin, has published the results of his investigations in the eleventh volume of the *Meddelelser om Grönland.* The greater part of the volume is devoted to a treatise on the Eskimo grammar and a comparative list of the independent stems of the Eskimo dialects—the Greenland dialect, being the best known, serving as a basis for this list. The first portion of the book includes a comparative view of the manners and customs of the Eskimo, tracing the Eskimo migration from west to east. Dr. Rink's theory

[1] *The Eskimo Tribes: their Distribution and Characteristics, especially in regard to Language.* By Dr. Henry Rink. Vol. xi. of the *Meddelelser om Grönland*: Copenhagen, 1887.

is, that the Eskimo reached the Arctic Ocean from the interior of Alaska, and from thence spread eastwards. His arguments are based on a comparison of the implements, dress and ornaments, domestic industries and arts, religion and folk-lore, and sociology of the Eskimo of Arctic America. He finds that the hunting implements are the more highly developed the further we proceed eastward, that the style of dress and habitations show a gradual approach to the Greenland style from west to east, and that the western tribes occupy a higher stage of social organisation than the eastern tribes. We shall here avail ourselves of Dr. Rink's patient and successful labours, and reproduce some of his observations in regard to the social life of the Eskimo.

Implements.—In a climate so rigorous and in lands offering such scanty means of subsistence, it is not surprising to find that the Eskimo, being in scattered tribes which have no cohesion one with the other, employ very primitive contrivances in their daily avocations. Of these the most important is the kayak, or men's boat. The Eskimo in the interior of Alaska, like their neighbours the Indians, use the birch-bark canoe for their fishing operations in the rivers, but at the river mouths the birch-bark is exchanged for sealskin, to cover the wooden framework, and at the same time to offer protection against the waves of the sea. This was the origin of the kayak, in its first stage of development. The waves which might swamp the fragile skiff are kept out of the kayak by the clothing of the occupant covering the well or opening in which he sits. This adaptation of dress to the necessities of life is found to vary throughout all the lands occupied by the Eskimo; it finds its perfection only in Greenland, where the kayakman wears a water-tight covering for the whole body excepting the face.

The kayak is propelled by a double-bladed paddle, the centre of which forms the handle. This paddle is unknown to the Eskimo proper in southern Alaska, who still use the one-bladed Indian canoe paddle; and it is not until we approach the north of the Yukon River that the first specimens of it are to be found. At Point Barrow (the United States International Polar Station) the one-bladed paddle still serves for ordinary use. Beyond the Mackenzie River the genuine Greenland kayak paddle is exclusively used.

The large harpoon with bladder and line, used for seal-hunting from the kayak, also undergoes various modifications of form. In southern Alaska we meet with harpoons furnished, like arrows, with birds' feathers. Seals, when hit, dive under water, to check which the bladder is affixed to the end of the harpoon line. This weapon, which is sometimes called the bladder-arrow, is found in all Eskimo countries, from Kadjak in Alaska to Greenland; but in southern Alaska it is unknown, although large bladders are there used in the same way by the Indians for whale fishing.

It is only in Greenland that hunting seals from the kayak is practised to perfection. The art of rising to the surface of the water, in the event of a capsize, by means of the paddle, although scarcely known in Alaska and Labrador, is considered to be the first qualification of a Greenlander who lays any pretension to the rank of a seal-hunter: and the same may

be said respecting the art of capture by means of the large harpoon and bladder, which requires years of practice. Curiously enough, the Eskimo of the East Coast of Greenland have improvements in their weapons which are unknown to the Eskimo of the West Coast, though the latter are in contact with the European settlements. For the whale fishing the open skin boat is used even more than the kayak, and, on the opposite shore of Bering Strait, the neighbours of the Eskimo, as far south as Kamtchatka, employ the same sort of boat. A remarkable uniformity in the methods of fishing is, in fact, found to exist throughout the Eskimo countries.

Dwellings.—During the brief summer the Eskimo live a nomadic life, wandering in parties, composed of as many as can occupy one tent or one umiak, as the women's boat is called. During the long winter they retire to certain stations, which for generations are occupied by the same stock. There is a broad distinction between the winter houses of the Alaskan and Greenland natives. The interior room of the former is in the form of a square surrounded by the resting-places, the entrance to which is on one side; in Greenland, on the other hand, the resting-places, or family benches, are all arranged on one side, and on this account the houses are more elongated in form, the length corresponding to the number of the residents. The Alaskan houses are smaller than those of Greenland, but in order to convene public assemblies, *Kagse* (pl. *Kagsit*; also *Kagge*, *Kashim*, *Kassigit*) are built, and these public buildings are found, from Alaska towards the east, in numbers corresponding to the narrowness of the dwelling-houses. In Southern Alaska the houses resemble those of the Indians, by having a hearth in the middle of the floor, with a hole in the roof for the escape of smoke. The houses are comparatively spacious, and are built mostly of wood, with earth on the outside only. Northwards, on the coast of Bering Strait, where wood becomes scarcer, the size of the inner room diminishes; the resting-places are reduced to the utmost narrowness; the hearth, for want of fuel, is replaced by blubber lamps; and the centre of the room, instead of being occupied by the women, is used as the working place. When wood becomes scarce, snow is used as the building material. In the neighbourhood of the Mackenzie River, snow-huts serve only for temporary occupation, as, for instance, during hunting expeditions; but in the Central Regions[1] they are used as regular habitations for a certain period of the year. They are narrow on account of their circular form, and for this reason they are furnished with side-rooms for different uses. In Greenland, or, at least, south of Melville Bay, snow-dwellings are not known to have existed, the houses being built of stones and earth. Greenland traditions speak of the *Kagsit*, or assembly houses, but chiefly as reminiscences of the earlier homesteads of their ancestors: Dr. Rink is not aware of the existence of these houses now, or at any other time, in Greenland. The Alaskan Eskimo have one very remarkable custom in common with the Indians,—the use of sweating baths. The *Kagses* generally serve for this purpose, but how far the

[1] Dr. Rink gives the name of Central Regions to the Arctic Archipelago between the continent of America and Greenland.—Eds.

custom passes beyond the shores of Bering Strait is not known; it is certainly abandoned before the regular use of snow-houses begins.

Dress and Ornaments.—The clothing of the Eskimo, as is well known, is almost the same for women as for men. It consists of trousers or breeches, and a tunic or coat fitting closely to the body; the head is also covered by the prolongation of the hood. The dress varies among different tribes, but the hood is common to all. Only in Southern Alaska are found exceptions to the general fashion; some of the coats resemble those of the Indians, in their length, and in the absence of a hood, and hats of a peculiar shape are in fashion. Another peculiarity of dress, is the widening of the head-covering for women, so as to form a cradle in which to carry infants. The mode of carrying babies in the widened legs of the women's boots, as in Labrador and some districts in the Central Regions, is quite exceptional.

The lip ornaments, or labrets, and the nose ornaments, common to the Indians and the Eskimo of Alaska, are obviously of American origin; they can clearly be traced from the south, where they were invented, to the north. The Thlinkit Indians pierce the lower lip, and insert an ornament of bone or stone in the opening, in pursuance of a ceremony in respect of age and sex. The same custom is observed by the Eskimo, who, however, employ two smaller labrets under the corners of the mouth, instead of the one large labret inserted by the Thlinkits through the middle of the lip. This difference in custom may be ascribed to climatic influence, for it must obviously be a severe test of physical endurance to expose the open lip to the intense cold of the Arctic Regions. This custom, which in Greenland is unknown, must have succumbed in the Central Regions.

As regards the dressing of the hair, a sort of tonsure is generally used by men in the West and on the Mackenzie River; beyond this district it is found in isolated cases—*e.g.*, on the coasts of Hudson's Strait and of Smith Sound. The women in the West dress their hair in platted lengths, but in Greenland the hair is rolled into a single thick tuft and is allowed to hang down perpendicularly. The latter fashion is first observed to the east of Point Barrow, and is combined with the plaits.

The use of masks at festivals and religious ceremonies is prevalent among the Alaskan Eskimo, but disappears towards the East. Like the labrets, which follow the same distribution, these masks show the affinity between the Eskimo and the Indians.

Domestic Industries and Arts.—As a general rule, each family manufactures its own utensils. We are told that in Alaska, not only the Indians, but some of the Eskimo tribes, know how to manufacture cooking vessels out of baked clay. The art of making pottery is supposed by ethnologists to mark an advance in culture, so that this supposition in regard to the Eskimo has a certain importance; in the remainder of the Eskimo territory, whether from the nature of the soil or the want of fuel, the art is quite unknown. The ordinary material used by the Eskimo for culinary vessels and lamps is the well-known potstone, the occurrence of which is confined to scattered districts

throughout the Arctic Regions. The skill shown by the Alaskan Eskimo in carving and ornamenting their weapons and utensils is sufficiently attested by travellers. This crude sense of the artistic steadily declines in proceeding eastwards from Alaska, and in Western Greenland scarcely any traces of it have been discovered. It is, therefore, remarkable that on the east coast of Greenland there should be found a small isolated tribe whose skill in carving and ornamentation rivals the Alaskan artists. Dr. Rink does not mention the name of the tribe, but we presume he refers to the Anmagsalik natives.

Religion and Folk-lore.—Among such a primitive people as the Eskimo, religion and folk-lore, as might be expected, are inseparably connected. From the investigations of Dall and Jacobsen, we learn that even the poorest tribes possess their burying-places, in which wooden statues, models of kayaks, etc., as well as coloured paintings on wood, are erected as sacrificial offerings to the souls of the deceased. The annual festival of masks in Alaska is designed chiefly to propitiate or intimidate the demons who have power over the fish of the sea and the rivers. The masks bear symbolic signs, and a general distribution of gifts and the performance of sacrifices take place on these occasions. In Baffin Land, according to Dr. Boas, similar customs are observed in the autumn, but in Greenland they are scarcely noticeable. A strong similarity in the folk-lore of the different tribes has been discovered to exist, but Dr. Rink does not venture in the present paper to propound any general principles.

Social Organisation.—The main principle underlying the organisation of the Indian *Gentes*, if it be taken as precluding the marriage between blood relatives, is also observable in the customs of the Eskimo, who have a high regard for birth. Communism in regard to personal property is partly forced on the Eskimo by their physical environment, and is also common to the Indians. Each of the larger households, comprising several families, has its chief, who is strictly obeyed and conscientiously venerated. Whilst, as regards the kayak and its use, implements and dexterity in using them, we have seen a marked progress in passing from the western to the eastern tribes, the reverse is the case with respect to social organisation. Dr. Rink points to this fact as a natural consequence of the dispersal of the tribes, by which the preservation of social customs became correspondingly difficult.

Our knowledge of the social organisation of the Eskimo tribes is so imperfect that only examples, and not general laws, can be given. The Anmagsalik natives of the East Coast of Greenland, who were visited by the Danish expedition which wintered there in 1884-85, and hitherto had had no contact with Europeans, offer one of the best examples. These natives are distinctly a tribe on a small scale. They numbered 413 souls, divided into 11 smaller communities occupying as many winter quarters, the greatest distance between them being 80 miles. Each community occupies a single house. In one instance it consisted of 58 persons, and in another of 38 persons or 8 families. In the latter case, the Danish explorers found the ledge along the wall of the room measured 28 feet in length and 5 feet in breadth; it was

divided by low curtains into 8 stalls, the size of which was in proportion to the number of persons in each family. The room measured 28 × 15 feet, the greatest height being 6½ feet. It is instructive to learn that, in spite of this limited accommodation for 38 persons during the long Arctic winter, "scolding or even unkind words," which are considered a misdemeanour, were never overheard. Every house or station has its patriarch or chief, whom all obey. There must be many grades of punishment between the legal process called the Nith Song (or the shaming of a person at a public assembly) and the severe punishment, witnessed by the Danish expedition, of turning a young man out of the house in the depth of winter.

Round the Danish settlements on the West Coast, where the Eskimo have been in contact with European influences for over a century, the native custom of living in common still exists, but the laws of hospitality are not so binding: hence, the natives have become impoverished.

The explorations of Dr. Boas in Baffin Land throw additional light on the so-called social organisation of the Eskimo. Owing to its scanty population the communities of Baffin Land are very small, more to be compared to the *Gentes*, though there is evidence of tribes existing. The traditional tales of Greenland sufficiently illustrate their social intercourse.

The Labrador Eskimo, like the Greenlanders, have also been under foreign influence. The tribes there who have not been "Christianised" have their chiefs, called *Angajorkak*—a term which in Greenland is used for "parents."

The Western Eskimo appear to be on a higher plane of social organisation than their brethren in the East. This is evident from the more favourable conditions for the acquisition of personal property. A remarkable prodigality is, moreover, shown in distributing gifts in order to acquire a reputation. The Inland Eskimo who inhabit the shores of the river Kuskokwim were stated by Wrangell to number 7000 souls. They had their fixed dwellings along the river, and, in the summer months, roamed about on hunting excursions.

Each village has its Kashim, or council-house, the interior of which is furnished with amphitheatre seats surrounding the stage for performances; in the middle is the hearth for heating the room. This building is, ordinarily, reserved exclusively for the adult male population, and is used for work or for holding councils. All public affairs are here discussed and decided. It is also used for public festivals. On such occasions the ceremonies commence with an exhibition of the spoil obtained by each huntsman; even children exhibit their stuffed birds. As soon as the people are assembled and seated according to rank, one of the chief hunters, surrounded by the people of his household or his partisans, commences the ceremony by singing a song, dancing and beating a tambourine at the same time. He then distributes gifts of game among the audience. The value of his presents, in relation to the number of his attendants, decides the rank which public opinion confers on him. Other hunters follow and act similarly. Feasting and merry-making intervene and continue for several days. Councils on serious matters are held, which no woman, unless solemnly

introduced, can attend. Blood vengeance is decided in this way. Sometimes the council declares war against other tribes. From these wars women and children are brought back as slaves, a custom which, apparently, is totally at variance with the social life of the Eskimo.

Distribution and Division.—If we include the Northern Indians under the chief groups—the North-Western, the Tinne, and the Algonkin—the Eskimo may be said to surround the Tinne from the seaward side, whilst in the west and the east they join the other two. In the west they issue almost as a continuation of the North-West Indians, obtaining means of subsistence partly from the land and partly from the sea. Where the territory of the inland Eskimo abuts on that of the Tinne tribes, the transition between their respective villages is scarcely perceptible to the traveller. But by degrees, passing towards the north and east, the Eskimo become an exclusively maritime and Arctic people, and their relations to the Indians are of a decidedly hostile character. On the Mackenzie River sanguinary fights take place between them; further towards the north-east corner of the continent, they are divided by a neutral country, which few attempt to cross. The principal routes by which the inland tribes of the west penetrated to the sea-coast were afforded by the rivers Athna, Kuskokwim, Yukon, Selawik, Kuwak, and Colville; the more easterly rivers must also have played a part in these migrations. This tendency to expansion led to the marvellous exploration by them of the Arctic Archipelago: the numerous ruins and other remains of human existence scattered over its shores, the peopling of Labrador, the wanderings of the tribes across Smith's Sound to Greenland and southwards to Cape Farewell, are testimonies of the same. The largest part of the Arctic territory having thus been discovered and explored by them, they divided into groups of tribes, whose roamings were generally restricted to removing alternately from one wintering station to another in the same neighbourhood, and to the usual summer excursions. They may therefore be divided geographically into groups, according to the territory which they occupy:—

I. The Western Eskimo comprise:—

(*a.*) The southern tribes: Ugalachmut, Kaniagmut (Kadjak), Ogulmut, Nushagagmut, Kuskwogmut, Magemut, and Ekogmut—numbering about 8300 persons.

(*b.*) The northern tribes: Unaligmut, Malemut, Kaviagmut, Okeeogmut, Selawigmut, Kowagmut, Nunatogmut, Nuwukmut—estimated at 2900 persons.

(*c.*) The Asiatic Eskimo, estimated by Krause to number 2000 persons.

There still exists a difference of opinion in regard to the classification of these western tribes. Dr. Rink obtains his distribution from the map of the Alaskan explorer, Dall.

II. The Mackenzie Eskimo, or Tchiglit, are separated from the Western by an uninhabited coast-line of 300 miles. Once a year, in the summer, they meet half-way for the purpose of bartering. M. Petitot divides them into Tareormiut and Kramalit, and estimates their number at 2000 persons.

III. The tribes of the Central Regions begin at Cape Bathurst, and are said to be sharply defined from the natives of this district. Our knowledge of these tribes, and of the vast region they inhabit, is, however, imperfect. Valuable linguistic contributions have, it is true, been made by Ross, Parry, Rae, M'Clintock, Allen Young, Schwatka, and Boas. Parry states that the south-western district is divided among the following tribes—Natsilik, Pelly Bay, Uvkusigsalik, Ukiolik, Kidelik (Coppermine River). Boas gives a detailed list of the inhabitants of Baffin Land, and describes the roads by which they have had intercourse with the more distant tribes.[1]

IV. The Labradorians. Upon the east coast of Labrador the number of natives is estimated at 1500, of whom 1163 were reported as "Christianised." The whole Eskimo population may be taken at between 2000 and 2200.

V. The Greenlanders. Of the native inhabitants of Greenland only the small tribe on Smith Sound, called Arctic Highlanders, seems to be related to those of the Central Regions. The Greenlanders may be divided into West and East. In 1880 the West Greenlanders numbered 9752, all of whom were "Christianised." In 1884 the East Greenlanders south of 68° north latitude numbered 548; north of this latitude, as is well known, natives have only been seen by Clavering, who in 1823 met two families north of 74½° north latitude. A. S. W.

LEADVILLE, COLORADO—GEOLOGY AND MINING.[2]

THE elaborate monograph named below has been prepared by Mr. S. F. Emmons, Geologist-in-charge. The work, he tells us, was undertaken at the instance of Mr. Clarence King, first Director of the United States Geological Survey, in 1879, and is now completed under his successor, Major J. W. Powell. The survey of the district was commenced under great disadvantages, there being no accurate and detailed topographical maps. These, however, were rapidly constructed by Chief Topographer A. D. Wilson, and Mr. Emmons and his assistants were forthwith able to determine accurately the position of the thousands of shafts and tunnels which penetrate the surface of that elevated region. The difficulties in the way of preparing a reliable geological map will be partially appreciated when we remember that climatic conditions prevented surface-work being carried on to advantage during eight months of the year—the ground traversed being sometimes buried under 15 to 20 feet of snow. In such a region superficial rock-rubbish is necessarily always abundant—the entire rock-surface, we are told, being covered with *débris*, so that the geological structure had to be made out by gathering into a connected whole the data derived from the innumerable openings which have

[1] *Scottish Geographical Magazine*, vol. ii. p. 162.

[2] *Monographs of United States Geological Survey*, vol. xii. *Geology and Mining Industry of Leadville, Colorado*, 4to, pp. 770, with folio Atlas in 35 sheets. Washington, 1886.

been made by the miners. The survey was practically completed in 1881, and the principal results arrived at were published in abstract in the Second Annual Report of the Director of the Survey, issued in the following year. Since that time the development of the Leadville mines has proceeded rapidly, and it is gratifying to learn that the general accuracy of the geological maps and sections which accompany this monograph has been confirmed by these later workings. Leadville stands at an elevation above the sea of not less than 10,150 feet, at the head of the Upper Arkansas Valley—a meridional depression 60 miles in length and about 16 miles wide—which separates the Mosquito Range from the Sawatch Range—the culminating points of each of those ranges having a remarkably uniform elevation of about 14,000 feet over sea-level. The earliest known exploration of the valley of the Upper Arkansas was that made by Frémont in 1845, but it was not till April 1860 that gold was discovered in the alluvial gravels of that region. The news of the discovery quickly spread, in spite of the difficulties of communication in that wild region, so that the few prospectors who first appeared upon the scene found themselves by the month of July in a community of some 10,000 persons. Fortunes were rapidly made : it is said that $2,000,000 worth of gold was taken out during the first summer—individual workers being credited with having carried away from $80,000 to $100,000 each as the result of their first summer's labour. The total gold derived from the alluvial gravels is generally stated at from $5,000,000 to $10,000,000, but a more cautious estimate places it at from $2,500,000 to $3,000,000. The climax was soon reached—the "placers" became practically exhausted, and the population in three or four years dwindled from thousands to hundreds. Few, if any, of the early miners seem to have suspected the existence of the real mineral wealth of the region, but eventually veins of gold and of silver and lead ores were discovered—the working of which has been prosecuted with much assiduity and abundant success. Leadville, as the centre of all this enterprise, has rapidly increased in size. Consisting at first of only a few scattered log-houses, it had, in 1880, 28 miles of streets, with a population of 15,000 inhabitants. Although the area from which ores are at present obtained is only about a square mile, yet the production is remarkable. The annual amount of silver alone is greater than that of any of the silver-producing nations of the world outside of the United States except Mexico. The lead product, again, is nearly equal to that of all England, and of other nations, outside of the United States, is only exceeded by that of Spain and Germany. In the magnitude of its product Leadville has only been surpassed in the United States by the famous Comstock lode in the Washoe district of Nevada. The approximate yield of the Leadville mines from 1877 to 1884 is given as follows:—Gold, 103,022 ounces; silver, 51,102,366 ounces; lead, 306,698 tons—the total value being $95,864,738.

The monograph before us is divided into two parts, the first of which deals with the Geology and Petrography of the region; and the second, with the Mining Industry, and the Chemistry and Metallurgy of the ores.

The simplest expression of the geological structure of the Rocky Mountains in Colorado is that of two approximately parallel uplifts or

series of ridges of Archæan rocks, upon whose flanks rest at varying angles a conformable series of sedimentary formations, extending in age from the earliest Cambrian to the latest Cretaceous epochs, the latter being locally overlaid by unconformable Tertiary beds. The eastern uplift is generally known as the Colorado or Front Range, and the western as the Park Range, the series of depressions or mountain-valleys between them having received the name of "parks." The great movement which lifted the Rocky Mountain region essentially into its present position appears to have taken place between the deposition of the Cretaceous and Tertiary formations. And some geologists have supposed that originally all the Palæozoic and Mesozoic strata covered the Archæan rocks throughout the whole region, and arched over these old rocks at the time of the great pre-Tertiary uplift. But Mr. Emmons conclusively shows that this was not the case. The stratified rocks never extended over the entire surface of the Archæan area; on the contrary, at the time of the deposition of the Cambrian and later sedimentary accumulations the Archæan rocks existed as a series of islands, along the shores of which the Palæozoic and younger strata were formed. With local oscillations, now in one direction, now in another, these conditions obtained up to the close of Mesozoic times, so that upon the whole we find a conformable succession of 10,000 or 12,000 feet of strata from the beginning of the Cambrian down to the end of the Cretaceous period, at which time the sea was gradually becoming silted up, and the waters of the ocean were slowly receding from the Rocky Mountain region. At this stage great igneous activity supervened, and enormous masses of molten matter were intruded through the underlying Archæan rocks into the overlying sedimentary deposits. These eruptions appear to have been intermittent, and continued during a considerable lapse of time, but they certainly preceded the great pre-Tertiary dynamic movements which caused the uplift of the Mosquito Range and the other ranges of the Rocky Mountains. These movements may be conceived as a pushing together from east and west of the Palæozoic and Mesozoic strata against the relatively rigid mass of the pre-existing Archæan land-masses, the result being that the bedded rocks were folded and crumpled most conspicuously in the vicinity of the old shore-lines. At the same time it is evident that the already violently contorted Archæan rocks of the old land must also have been subjected to renewed crushing and contortion, during which the axial regions would be pushed up to a great height, probably much exceeding that of the present culminating peaks. Along with the east and west movements there acted a minor force of contraction in a north and south direction, whose effects are now visible in gentle lateral folds, the axes of which trend approximately at right angles to that of the Rocky Mountain ranges. Mr. Emmons points out that these great dynamic movements must not be regarded as having been completed in a short time; they were not of the nature of convulsions like earthquakes, but rather slow and gradual movements extending over a prolonged period of time. Indeed it can be shown that the movement continued into so recent a period as the Glacial Epoch, and may very probably be going on at the present day. It was during the time that intervened between the

intrusion of the eruptive rocks and the great uplifting movement that the original deposition of metallic minerals in the Leadville district took place. This is proved by the fact that the ore-deposits have been folded and faulted together with the rocks in which they occur. The minerals are believed to have been formed by percolating waters which, having eaten up certain ore-materials in their passage through the neighbouring eruptive rocks, deposited these again in a more concentrated form in their present position. The original condition of the ores seems to have been that of sulphides, but they are now chiefly oxidised compounds, the result of a secondary chemical action. The most important of these ores occur in a blue limestone of carboniferous age, at or near its contact with an overlying mass of porphyry. They consist principally of argentiferous galena, but other kinds of lead-ore exist, as well as ores of silver, while gold is met with in the native state, generally in the form of minute scales or leaflets. As accessory minerals the ores of other metals also occur, such as ores of zinc, arsenic, antimony, molybdenum, copper, bismuth, vanadium, etc.

After the great pre-Tertiary dynamic movement, the igneous forces again began to manifest some activity, considerable outpourings of lavas taking place during the succeeding Tertiary period. These eruptions are not only later than the folding and fracturing of the older strata, but seem to have occurred after erosion had done the greater part of its work in the removal of Palæozoic sediments. So far as observed, these Tertiary eruptions had no influence upon the ore deposits of the region. There is everywhere evidence of enormous denudation having supervened since the period of the great uplift, the tops of the folded strata having been removed, and large masses of the Archæan rocks having likewise been demolished and carried away. How much of this denudation was accomplished before the glacial epoch cannot be determined, but it is obvious that the Arkansas valley existed as a deep valley at the beginning of that epoch, since a large lake was formed in it from the first melting of the ice, the lacustrine deposits now occupying the valley being some 300 feet in thickness. It seems probable, however, that this valley occupies a line of depression formed by the elevation of the Mosquito Range and the accompanying dislocations of the rocks. A new drainage system was in this way initiated, which subsequent erosion has deepened and enlarged. The author is of opinion that, although much denudation was accomplished before the glacial epoch, yet that the carving and shaping-out of the valleys which score the flanks of the Mosquito Range have been effected chiefly since glacial times.

It is impossible within the compass of a short notice to present any outline of the various theoretical matters which are so ably handled in this elaborate treatise. Geologists will read with interest what Mr. Emmons has to say with regard to the origin of the structural features of the region and the genesis of the various ores, while petrographers will thank Mr. Whitman Cross for his account of the eruptive rocks, the older series of which consists of quartz-porphyries, diorites, and porphyrites, and the younger of rhyolites and andesites. The chemistry of the ore is ably discussed by Mr. Hillebrand, and the metallurgy by Mr. Guyarp.

The work is illustrated by forty-six plates exhibiting points of interest in the geological structure of the region, microscopic sections of rocks, and the various arrangements and implements employed in the metallurgical processes. The accompanying large folio atlas shows the topography and geology of the region, the structure of which is admirably illustrated by an elaborate series of horizontal sections, etc. Altogether, this latest addition to the monographs of the United States Geological Survey reflects the greatest credit on Mr. Emmons and his associates, and fully sustains the scientific reputation of the department over which Major Powell presides.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

A MEETING of the Society was held in the Freemasons' Hall, Edinburgh, on the evening of 26th February, General Sir R. Murdoch Smith, Member of Council, presiding. Mr. Joseph Thomson read his paper on "Explorations in the Atlas Mountains," which we publish as our first article this month, and was accorded a vote of thanks on the motion of the Chairman. The paper was illustrated by lime-light views.

Mr. Joseph Thomson re-delivered his lecture on the Atlas Mountains to the members of the Glasgow Branch of the Society, in the Queen's Rooms, on February 28th. Mr. Renny Watson, Chairman of the Glasgow Committee, presided. Professor Henry Drummond moved, and Sir Michael Connal seconded, the vote of thanks to Mr. Thomson.

Mr. Philip Sewell read the paper we publish this month entitled, "In Arctic Seas: Lapland and Siberia," to the members of the Dundee Branch of the Society, in the Y.M.C.A. Hall, on 26th February, and to the members of the Aberdeen Branch of the Society, in the Albert Hall, on the 21st February. The paper was illustrated with lime-light views. Principal Petersen presided over the meeting in Dundee, and Dean of Guild Stewart over the Aberdeen meeting.

A meeting of the Society was held in Dowell's Hall, Edinburgh, on the 14th March—General Sir R. Murdoch Smith in the chair—when Dr. Hugh Robert Mill lectured on "Scientific Earth-Knowledge as an Aid to Commerce." Mr. William C. Smith, advocate, moved the vote of thanks to the lecturer.

Dr. Mill repeated his lecture, on the evening of 19th March, at a joint meeting of the Glasgow Branch of the Society and the Philosophical Society of Glasgow, in the Hall of the latter Society. Dr. W. G. Blackie presided.

GEOGRAPHICAL NOTES.

EUROPE.

New London.—Under the Local Government Act, 1888, London has been created into a separate county for administrative purposes. This was necessary, because the general scheme of the Act is to set up a Council in every county. But London was situated in parts of the counties of Middlesex, Surrey, and Kent, and it would have been impossible to apply the scheme to these counties with their former boundaries. Hence London becomes an administrative county. It is unnecessary to define its well-known limits. They are described

in the schedules to the Metropolis Local Management Act, 1855. Everybody has a general notion of the territory formerly governed by the Metropolitan Board of Works. The London County Council consists of a chairman (our President, the Earl of Rosebery), 19 aldermen, and 118 councillors. The old City of London remains an electoral division in this new county. Its internal municipal government is scarcely touched by the Act. The appointment of the Sheriff of Middlesex is transferred from the Livery of the City to the Crown. The appointment of the Common Serjeant is similarly transferred from the Common Council. The jurisdiction of the Court of Aldermen in granting music and dancing licences is transferred to the new County Council. But except in a few particulars such as these the old unreformed municipal corporation of the City of London remains where it did. Of course, for all *non-administrative* purposes—*e.g.* quarter sessions, militia, coroner, sheriffs, etc.—the City of London also remains a county as before. But, what is new, the metropolis outside the city of London is constituted a county by the name of "the County of London." "The result is," as Messrs. Firth and Simpson say in their recent work on London Government, "that for non-administrative purposes there will be two counties, the county of London and the county of the City of London, but for all the other purposes of the Act the metropolis will be one county, and will be subject to the jurisdiction of the London Council."

ASIA.

The Coral Reefs of the Sinai Peninsula.—The conditions determining the growth of coral reefs are still, as is well known, a subject of dispute. Dr. Johannes Walther has discussed them in a pamphlet entitled *Die Korallenriffe der Sinaihalbinsel.*[1] Darwin's theory of subsidence, which Dr. H. B. Guppy examined (*S. G. M.*, vol. iv. p. 121) and found wanting, is rejected by Dr. Walther also. To gain a thorough knowledge of the history and construction of the coral reefs of a small part of the world seemed to him the method most likely to lead to good results, and he considered that such knowledge could be based only on a detailed investigation of the distribution and extent of the reefs, the nature of the foundation on which they are built, their structure, and the changes which take place in them. Dr. Walther spared no time or trouble. He travelled along the coast of the peninsula from Suez to Ras Mohammed, and crossed the desert El Kaa four times. He also examined the living reefs, walking about them himself, and employing divers and dredges. In the Gulf of Suez three reefs are to be found; an older and a younger fossil reef, and the living reef. Fringing reefs of small extent are found in the northern part of the Gulf of Suez, but it is from Hammam Musa, near Tor, to Ras Mohammed, that the coral grows most prolifically. In some places the coral leaves the shore and forms barrier-reefs. Near Ras Mohammed, and still more on the African coast opposite, lie several lines of reefs and numerous atolls. A few remarks may be made on the manner of growth of coral. It branches out on all sides like a huge umbel, whereby its polyps are well provided with fresh sea-water, and, as these umbels are shallow, little resistance is offered to the waves. The umbel begins to die from the inside, large animals break off the small branches, hermit crabs and other small animals reduce the fragments to minute grains, while annelids and other organisms perforate the interior of the structure. By this

[1] *Die Korallenriffe der Sinaihalbinsel*, No. x., vol. xiv., of the *Abhandlungen der mathematisch-physischen Classe der Königl. Sächsischen Gesellschaft der Wissenschaften.*

action, a compact and homogeneous mass is formed, which, firmly bound together by *algæ* and other plants, forms a foundation for another layer of coral. Madrepores require more abundant fresh sea-water than *Stylophora*, and therefore grow only on the outer edge of the reef, and have shallower umbels. The reefs have no great depth. The older fossil reef never attains a depth of fifteen mètres, the younger, which may more easily be measured, may at Ras Mohammed be as much as nine mètres deep, while the living reef, as far as Dr. Walther could ascertain, is somewhere about three mètres deep. The coral always builds on compact rock, for its slender trunks must stand on a firm foundation, that the whole structure may not be displaced by the violence of the waves. The older dolomitic reef lies at Jebel Hammam Musa on soft marl, deposited unconformably on Nubian sandstone. Elsewhere it lies immediately on the sandstone, but breaks off where the sandstone gives place to porphyry, tufa, and other crystalline rocks of less solidity. The younger reef lies on the extremities of strata of white chalk, and at Jebel Nakus and Jebel Hammam Musa on Nubian sandstone. The foundation of the living reef from Wadi Faran to Ras Mohammed is well shown by a series of sections drawn at right angles to the coast, that is, SW. to NE. Where the coast is bounded by the crumbling granite of the Araba chain, no coral is found, but, further south, where the granite dips into the sea, and is succeeded by Nubian sandstone, *Exogyra* chalk, etc., fringing reefs are formed. Here also, as well as elsewhere, reefs are found on a rising coast, the displacement of the shore-line causing an increase in the width of the reef. To sum up, then, Dr. Walther concludes that coral reefs consist only of thin layers on a foundation of solid rock, and are not built up to a considerable depth as subsidence takes place. His pamphlet is illustrated with numerous drawings and a geological map of the western part of the Sinai peninsula.

AFRICA.

Transvaal.—The following extracts from a private letter from the Hon. J. X. Merriman, M.L.A., formerly Commissioner of Crown Lands and Public Works in the Cape Colony, has been sent to us for publication, by Mr. John G. Gamble :—

"The Transvaal gold-fields are undoubtedly an assured success, and very curious from every point of view, particularly the geological one. To the north of Pretoria lies the Magaliesberg mountain range, running more or less east and west. The sandstones and quartzites of which it is composed are tilted up, and dip northward. The rocks of the Wit Water's rand mountains, which lie some thirty-five miles to the southward, are also tilted up, but dip south. The conglomerate reefs which carry the gold are interbedded with the sandstones and quartzites, and follow their dip. The anticlinal axis has apparently been upheaved and broken by the intrusion of granite, and then denuded. Johannesburg, which stands on the crest of the Wit Water's rand, is 6000 feet above sea-level; Pretoria is 4450. The reefs run about due east and west, and are regular for 40 or 50 miles. Breaks occur in the mines where the reef has been forced out of its natural course, and at a lower level immediately below no such break occurs. The quartz pebbles in the conglomerate are rounded and waterworn, and contain no gold; but the gold is angular, and exhibits no trace of having been exposed to the action of water. Diamonds have been found in the conglomerate. I was not able to hear of any fossils having been found in the sandstones. There are several parallel reefs; only one, however, called the main reef, has much attention paid to it. This carries about 10 to 12 dwt. of gold to the ton, but alongside are extremely rich 'leaders,' or subsidiary reefs, which carry 3 to 4 or 6 oz. to the ton. Whether

this is uniform all along the whole distance that the reef has been traced is doubtful. . . . The Transvaal has coal of excellent quality in abundance ; gold, silver, copper, nickel, probably tin. As for agricultural resources, coffee grows luxuriantly in certain parts ; so does rice. Corn grows everywhere. All the country wants is population. The climate on the High Veld is charming, even cold in summer."

AMERICA.

United States Geological Survey.—Major Powell, the director of the Survey, has sent in his report, of which a brief summary is given in *Science* of 28th September last. As many as 52,062 square miles of country has been surveyed during the year. In some districts a large scale of map, two miles to the inch, has been adopted. Dr. Arnold Hague has been engaged in geological work in the Yellowstone Park district, and has made many instructive observations of the geysers and hot springs. He was struck with the suitability of this district as a storage area for the waters of the Missouri and Snake Rivers. Professor N. S. Shaler has examined the swamps and marshy lands. There are over 100,000 square miles of such land in the United States, a great part of which might be drained and rendered productive. In many places it abounds in peat and iron, and in South Carolina and Georgia it contains phosphates, which are being extracted in increasing quantities. The late Professor Roland D. Irving investigated those metamorphic rocks, the date of which is uncertain owing to the destruction of their fossils, and for this purpose he chose the Green Mountains of Vermont and Massachusetts. Professor T. C. Chamberlin has examined basins formed by glacial action. Near the close of the glacial period, in the country through which the Red River of the north and the Saskatchewan now flow, stood a great lake, to which the name of Lake Agassiz has been given. The portion of this lake basin which lies in the United States territory has been explored by Professor Chamberlin's assistant, Mr. Warren Upham, in co-operation with the Canadian Geological Survey. Probably the most important part of Major Powell's report is his proposal for a new classification of soils. He divides them, in the first place, into two classes, endogenous and exogenous soils, the former derived from the neighbouring rocks, the latter composed of materials brought from a distance. The former are distinguished by the names of the rocks they are derived from, the latter by the agencies through which they were formed, *e.g.* lacustrine soils, drift soils, marsh soils, etc.

Arequipa, Peru.—The President of the Arequipa Society has received a letter from Dr. A. Hettner describing the physical and geological features of the coast land of Peru between Mollendo and Arequipa. An even strip of country, only a few miles broad, rises either immediately from the sea or from an intervening belt of sand. Its inland border attains a height of rather over 1300 feet, and lies at the foot of a chain of hills called the Lomas, about 3600 feet high. Beyond this chain, and only some 300 feet lower, lies another plain, inappropriately named Pampa de Islay, between the valleys of the Rio Chili and the Rio Tambo, but extending far beyond these limits. This plateau is about 25 miles broad, and, like the first, rises very gently ; on the north-eastern edge it attains an elevation of nearly 5600 feet. Here a range, usually called the Cerros, separates it from a third plain, the plain of Arequipa (8990 feet), which, in contrast to the others, is bounded on the north-east and south-west by ranges of hills, and is probably a local feature. To the north-east rise the three great volcanoes, Pichu-Pichu, Misti, and Chachani.

The Lomas and the Cerros consist of primitive crystalline rocks, gneiss, granite, syenite, etc. On the crest of the Lomas only dolomitic rock lies on the primitive rocks, with a slight dip towards the sea. The primitive rocks appear also on the south and south-east of the plain of Arequipa, in the deep valley of the Rio Chili, under strata of tufa and conglomerate, and elsewhere; but what part they occupy in the structure of the mountains, and how the intervening depressions have been formed, are questions yet to be solved. In the lowest plain the rugged surfaces of these rocks are rounded off by new formations of sand, clay, and pebbles, so as to produce a slightly undulating country. This has, no doubt, been the work of the sea, a view confirmed by the presence of marine shells—unfortunately, however, too much broken up to serve as indications of the age of these later deposits. The other two plains, as far as can be ascertained, consist of recent formations, volcanic boulders and lava being found in both, but especially in the plain of Arequipa. This town is entirely built of a very hard tufa. The strata are everywhere horizontal. The climate of the Peruvian coast is not of the usual tropical character. The south wind, that is, from the Pole, blows throughout the year, and, assisted by the cold current flowing northwards, reduces the temperature several degrees below the normal for those latitudes. Another consequence of this wind is the exceedingly small rainfall. Heavy rain descends only at long intervals; the coast lands, as far as the Pampa de Islay, receive moisture only from thick mists, and in winter the sky of Arequipa is remarkably clear and cloudless. Hence, the only perennial streams are those which descend from the snow-clad peaks, and they only have excavated deep beds and ravines. The surface of a great part of the country therefore retains its original contour, especially in the Pampa de Islay, where few river-beds of any kind exist. On this plain a curious formation may be seen, namely, the semi-circular sand-banks, called *Médanos*. They are caused by the wind, and therefore their convex side is turned towards the south, the quarter from which the prevailing wind blows. They are about 90 feet in diameter, and 16 to 20 feet high. The vegetation in such regions is, of course, sparse. Grasses and herbs shoot up on the Lomas in the time of the winter mist, but the Pampa de Islay is absolutely a desert. The Cerros are not so poor in vegetation as the Pampa, but it consists only of cactuses and thorny bushes. Under these circumstances the population is, naturally, small; a few fishermen dwell on the shore, a few herdsmen feed their flocks on the Lomas during the winter, and there are villages on the Rio Tambo and Rio Chili. But the most numerous agricultural villages are to be found in the plain of Arequipa, an oasis lying between the desolate hills and plains towards the coast, and the equally desolate *Punas* or plateau on the other side.—*Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, vol. xv., No. 8.

AUSTRALASIA.

Reported Active Volcano in Central Australia.—Mr. David Lindsay, the South Australian explorer, reports his belief in the existence of an active volcano in Central Australia. Mr. Lindsay, on returning from his visit to the Macdonnell Ranges, was interviewed by a representative of the *South Australian Register*, and is reported to have said, in regard to the supposed volcano:—"You have heard about P. T. Willshire seeing what he thought was an active volcano. I believe he was quite correct. The situation is, I think, between 150 and 200 miles north-west of the Alice Springs telegraph station. There are a few blacks at Alice Springs who come from that part of the country, and their statements are so precise in every respect that I am sure that there is a volcano. They say

that there is a hill that is always burning ; it growls, and throws up sand and stones. They do not care to talk much about it. They are afraid of it, and regard it as an evil. They say, 'It is no good ; blackfellow did not make it.' The country where it probably lies has been pretty well explored, but any one seeing the smoke ten miles off might ascribe it to a blackfellow's camp. Some years ago I was told by the blacks of a burning mountain north-west of the one discovered by the trooper in Western Australia."

If there be any truth in this native report, the supposed volcano will probably turn out to belong to the class of *mud-volcanoes* or *air-volcanoes*, which are not true volcanoes, but appear to owe their origin to chemical changes in progress underneath. Naphtha and inflammable gas are frequently present in air-volcanoes.

The Aru Islands.—The *Festschrift zur Jubelfeier des 25jährigen Bestehens des Vereins für Erdkunde zu Dresden* contains an account of the Aru Islands from the pen of Herr Karl Ribbe, an entomologist. They lie between 134° and 136° E. long. and 5° and 7° S. lat., and have, therefore, Australia to the south and New Guinea to the east of them. The island Tanah Bessar is much larger than any of the others, which encircle it, numbering in all nearly 500. The south-eastern part of this archipelago is called Balakan-Tanah, the opposite part, Muka-Tanah. Tanah Bessar, the mainland, is divided into several parts by singular canals, called *Sungis*. The channels run right through the island, preserving as a rule nearly the same breadth throughout, and are, of course, filled with salt water. With regard to their origin, Herr Ribbe quotes the opinion of Professor Wallace, recorded in his *Malay Archipelago*. It is, that the Aru Islands at one time formed a part of New Guinea, and that these channels are parts of the beds of rivers, which at that time flowed down from the mountains of New Guinea as far as Aru. Herr Ribbe demurs to this conclusion, and asserts that they are true sea straits of small breadth, gradually excavated by the currents that prevail between high and low tide. This theory, he argues, will also explain the existence of numerous small channels, having only one opening to the sea, and in all respects resembling rivers save in the saltness of their water. That the Aru Islands were formerly connected with New Guinea is beyond doubt. It is proved by the shallowness of the sea between the islands, and the similarity of their fauna, two or three varieties of butterflies being peculiar to Aru and New Guinea, while of 160 *Lepidoptera* collected by Herr Ribbe, no less than 100 were common to both lands. The coast of Aru is steep and rocky ; swamps are common near the mouths of the streams, both salt and fresh. Ranges of hills barely 1000 feet high stretch a long distance across the country. The rock is purely coralline and little different from mountain limestone. All the islands are covered with dense forest, and fine scenery abounds. The native race is only to be distinguished from the Papuan by the absence of woolly hair ; in build, colour, manners, and customs the two peoples are exactly alike. The fauna can vie even with South America in the brilliant colouring of individual varieties, and possesses superior attractions in its birds of Paradise and its butterflies. Very rare and beautiful specimens of birds also are to be found in Aru, and here also proof of the original connection of the islands with New Guinea presents itself, for, out of 100 varieties of birds collected by Wallace, 80 were common to both countries. Of Mammalia, Herr Ribbe found several varieties of bat, a kangaroo, a pig, and a stag, the latter having been introduced by Macassar men. The climate is unhealthy for Europeans, owing to the injurious miasma

which rises from the salt swamps. The dry and rainy seasons are not sharply defined, as in most tropical countries. The year in which Herr Ribbe visited Aru, 1882, was exceptionally wet, rain falling 250 days out of 365, while at other times great drought sets in, the few insignificant fresh-water brooks are dried up, and the natives, with their cattle, are obliged to seek shelter in the depths of the shady forest, where a few puddles of rain-water may still be found. The religion of the people has been well defined as fetichism inclining to polytheism. They must possess some dim belief in a future life, for they hold it a crime to speak disrespectfully of their forefathers, and hold that such misdeeds are punished by the spirits of the departed. Some Christian villages exist on the western islets and coast of the mainland. The Dutch Government gives great assistance to the missionaries in all parts, and sent missionaries from Amboyna to Aru. The Christian convert is not a man who excites much admiration ; he drinks, and behaves with more unblushing effrontery to Europeans than his heathen or Mohammedan fellow-countryman. The heathen and the Mohammedan do but little work, the Christian none. The Mohammedan is not permitted by his religion to drink intoxicating liquors, but he has become thoroughly demoralised by the fearful habit of smoking opium. The Mohammedans wear white, the Christians dress like the Amboyna people in a semi-European fashion. Herr Ribbe saw in Watulei, one of the eastern isles, a hideous image consisting of a spherical head, with holes for eyes, and a projecting triangular piece of wood as nose, set upon another shapeless rounded block. This was the Aru *Pomali* or god. The word *pomali* signifies simply *sacred, set apart*, and apparently is in meaning identical with the Tahitian *tabu*. No one will venture to take fruit from a tree which a man has made *pomali* by setting his mark on it. Images of gods and stone hatchets are reverenced as sacred things. The origin of the latter is not known to the Aruans, but they take them for thunderbolts. The belief that something tangible falls, when a a flash of forked lightning is seen, is spread over all the Dutch East Indies, and Herr Ribbe might have added, over all Europe. Every family has its particular sign, its crest or totem, which is carved on a conspicuous beam in the house. Among such crests may be mentioned human figures, elephant's tusks, snakes, cutlasses, bêche-de-mer, gongs, starfish, etc. These also are *pomali*. Witchcraft is thoroughly believed in, and medicine-men are employed to detect the wizard, and superstitions of all kinds are firmly rooted in the minds of the savages. Different dialects are spoken in individual villages, and traces are to be found of Spanish and Portuguese words. It is difficult to understand the Arunese, because they all speak through the nose. They sing at all their feasts and at their work in a monotonous fashion, accompanying themselves with flutes, blown with the nose or mouth, a drum of the kind used in the Moluccas, the Chinese gong, and the rabana of Macassar, whereby at their festivities they produce an infernal noise, which the European has to endure in silence for fear of offending the performers. A rocky promontory is usually chosen as a site for a village, as affording greater security against the attacks of an enemy. It is often 50 to 80 feet high towards the sea, and therefore impregnable, while the land side is fortified by a strong stone wall. The houses, of a quadrangular plan, are raised on carved pillars sunk into the solid rock. The framework is formed of strong wooden beams, the walls of the leaf-ribs of the sago-palm or of palm leaves, and the roof of the same material, but carefully prepared for the purpose. The house is divided into two rooms, one surrounding the other. The latter is rather the higher, and contains the fire-place, the sleeping-places, and the stores. The occupiers gain access to the houses by ladders of simple construction, or by

notched trunks, which they draw up when attacked, thus forming each house into a small fortress. By similar ladders they descend from the rocks into their boats. In some parts the houses are occupied by only one family, but in others they afford shelter to more than 100 persons. The Arunese are divided into two brotherhoods, the Uli-luna and Uli-siwa, confederations which extend over the whole Molucca Archipelago. The origin of the enmity between them cannot now be ascertained. The whole of Aru is under the control of two Dutch officials. The Uli-luna in the west are under the rule of a rajah, and Christians, Mohammedans, and heathen are to be found among them. The Uli-siwa have no sole ruler, but each village has its head-man, whose authority, however, is but slight. Slavery in a mild form exists. A mysterious tribe, the Korong-eis, dwells on the mainland of Aru, which holds no further communication with the other inhabitants than is absolutely necessary for the exchange of goods. Even then they do not show themselves, but lay the wares they collect—birds of Paradise and the swallows' nests used by the Chinese to make soup—on a certain stump, together with models of the articles they want in exchange, and then retire into the woods, until the dealers on the other side have transacted their business and left the spot. According to the reports of Arunese, the Korongo-eis have white skins and light hair, and are of European descent. Agriculture is in a very primitive state, and but a small number of plants are cultivated. Maize, sugar-cane, beans, five kinds of potatoes, gourds, and bananas are grown, and a few European vegetables, such as lettuce and radishes, have been introduced among the Christians. *Sirih* and coco-palms are planted wherever they will grow. Sago is the chief food. This palm is not quite so tall, but much stronger than the coco-palm, and bears exceptionally large, spiky and downy leaves. It puts forth a large blossom, when it is 10 to 15 years old, and then dies. It grows in swamps either of sweet or brackish water, but finds nourishment also on rocky hills where there are swampy hollows. To obtain sago a full-grown tree, which has not blossomed, is chosen ; it is cut down and the bark stripped off one side, so as to expose the pith, which is then beaten with a club, having a piece of quartz projecting half an inch from the thick end. The woody fibres which run through the pith are broken by this means into short lengths, and, when the process is completed, the sago is separated by washing. It is formed into cylindrical masses, and wrapped in sago leaves, and appears in trade under the name of raw sago. It is also made into loaves, in which state it will keep for years. The savages seldom eat animal food, not because game is scarce, but because they are too lazy to hunt ; cassowary eggs are eagerly sought for, and occasionally fish is caught. The Arunese make wine from the coco-palm, and are great adepts at consuming brandy and arrack. Like all Indian tribes they chew *sirih* (betel-leaf), a habit introduced probably by the Malayan traders. A loathsome skin-disease, certainly rife among all sago-eating tribes, and probably due to excessive consumption of that food, is very common here also. The dress of the Christians and Mohammedans has been noticed already ; the heathen Arunese wear around the loins cloths made of bast, and a few, in the most frequented places, have a kerchief round the head, in imitation of the traders. In some parts the women wear only a small apron, and in a few villages go quite naked. The women draw their hair back into a knot, in which they fasten a small shell-shaped ornament of brass. Various combs and pins also, elegantly carved out of wood, bone, ivory, mother-of-pearl, and tortoise-shell, are stuck in the hair. All, men, women and children, wear amulets, consisting of a small bag suspended round the neck, in which is placed a variety of odds and ends, such as curiously-shaped stones,

beads, calculi of animals, etc. Bands are worn on the upper arm of finely divided *Pandanus* leaves, woven together and trimmed with small coloured glass beads and strips of printed calico, and the lower arm carries bracelets of mother-of-pearl, tortoise and other shells, brass, etc.; finger-rings also are made of these materials. The legs, ears, neck, hips, and all parts of the body are laden with ornaments. The native weapons are lances, bows and arrows. The lances are round sticks, three yards long, or rather more, and the arrows are made of a kind of cane. The heads for these weapons are made, as usual among savages, of stone, wood, bone, and, in recent times, of iron. The arrowheads for shooting birds of paradise are blunt, that the skin may not be broken and the feathers stained with blood. Dr. Ribbe saw a very original club, the thick end of which was studded with nails, so as to resemble a *morning-star*. The Aru shield also deserves notice. It is rectangular, and is composed of Malacca cane firmly woven together. It is suspended round the neck, and has a hole in the centre, through which the warrior passes his left arm, a device which enables him to hold his bow and aim without exposing his body. Many of the boats came from the Kei Islands, but one is of native design. It has two projections at the prow, one over the other, and a long and elevated tail at the stern, which is usually decorated with woodwork. The house utensils are few; the spoons, of nautilus-shell, are of useful and elegant shapes. The hard coating of the Malacca cane, *Pandanus* leaves, and finely split bamboo are the materials employed in the manufacture of boxes and cases; mats and sails are made of *Pandanus* leaves, and also of bast, ropes and string of bast, lianas, Malacca cane, and the black fibres of the sugar-palm (*Areca saccharifera*), and are far tougher and more lasting than European ropes. Pottery is manufactured chiefly in three particular villages, which happen to lie close to deposits of clay. The clay vessel is made as symmetrical as possible by the hand, and is finished by placing a punch from within against the side and striking against it with a mallet on the outside. Iron has latterly been worked to a small extent. The bellows consist of two wooden cylinders, in which pistons are worked alternately. The most valuable exports are pearls; others of importance are mother-of-pearl, bêche-de-mer, swallows' nests, and the plumage of birds of paradise. The tortoise-shell is of good quality, but is brought to market only in small quantities. The imports are—arrack from Java; cognac and brandy of bad quality from England and Holland; rice from Java, India, etc.; cotton goods, knives, thread, needles, choppers, axes, boats, etc. Only a few words can be said about the national customs. A wife is bought, and if the price be not paid, the father has a claim on the children of the marriage. Polygamy is permitted, but little practised. When a man dies, his body is placed in a cylindrical coffin of sago-palm leaves suspended to the rafters of the house, where it remains until it is thoroughly decayed. A symposium is held every evening. The women during the days of mourning live apart, throw off all clothing, and perform the funeral dance every evening. In some villages they shave themselves, a custom prevailing among some of the African Negroes. Old and sickly people are put to death, and deformed children are killed immediately after birth.

ROUTES, RAILWAYS, CANALS, ETC.

Railways in China.—In an article on *Railways—their future in China*, in the March number of *Blackwood*, Mr. William B. Dunlop sketches the difficulties which beset railway construction in the great empire of the Far East. Chief among these difficulties is that of finance, coupled with the scarcely less

important question—native *v.* foreign management. After discussing the various points which for the present bar the way against extensive railway construction in China, Mr. Dunlop goes on to compare India with China in the matter of water highways, and endeavours to show that there is not the same necessity for a great railway system in China as there is in India. Mr. Dunlop maintains that, instead of at present conjuring up an idle vision of a great railway system for China, we ought rather, as a preliminary step, to endeavour to prevail on the Chinese Government to open to steamers those innumerable magnificent water highways, rivers, and canals, which still remain sealed to foreign enterprise. Then, when a railway is found to be absolutely necessary in order to tap rich tracts of country unreached by waterways, let that individual and specific railway scheme be ventilated and agitated. After we have provided the "rolling stock" in the shape of flotillas of steamers for the "permanent way" of China, in the shape of rivers and great canals, Mr. Dunlop thinks it will be time enough to consider the question of a great railway system.

Railroad Statistics.—Professor A. T. Hadley, of Yale University, has attempted the difficult task of comparing the development and utility of railways in Europe and the United States (*Bulletin de l'Institut International de Statisque*, tome iii. 2^{me} livraison). What kinds of statistics fairly represent the comparative utility of the railways of these countries? Professor Hadley rejects the ordinary method of comparing mileage with area or with population on the ground that in a thinly populated country, the mileage is small compared with area, and large compared with population, while the contrary law holds good of a densely populated country. The equipment gives results but little better, seeing that cars and locomotives differ in capacity and tractive power, respectively, and are better utilised in one country than another. Other statistics labour under the disadvantage of not being procurable from all countries, for instance, ton-mileage and passenger-mileage are not reported by England. The following table gives the train-mileage for every 1000 inhabitants in 1884 :—

	Passenger.	Freight.	Total.
United States,	3700	6000	9700
Great Britain,	3981	3523	7504
Belgium,	2258	2241	4499
France,	2222	1336	3558
Germany,	1971	1287	3258

It may, then, be roughly estimated, that for every inhabitant a train is run ten miles annually in the United States, seven and a half miles in England, five in Belgium, three and a half in France, and three and a quarter in Germany. Trains are more frequent in Europe than in the United States, but against this superiority must be set the greater distances they run in the latter country. In England the average is 40 trains a day, in Belgium 26, in France 20, in Germany and Holland 18, and in the United States 13. Of course this last number is reduced by the small number of trains run in the Western States—about 6 a day, whereas in the Middle States the number is 25. Professor Hadley prefers *pro capite* train service to density of traffic, that is, the ton or passenger mileage per mile of line, because the density will be greater where only a few very profitable lines are built. This is no doubt true; but in what country of Western

Europe is such a state of things to be found? Neither is it the case in America, to judge from the dividends. Where railways are managed rather with a view to speculation on the Stock Exchange than to the advantage of the shareholders, and competition is carried to excess, as too frequently happens in America, the train mileage may be unnaturally increased, trains often being run at a loss to the company. Figures therefore can be satisfactory only when they show the actual amount of work done, which the figures given above do not. This defect must also affect the value of Professor Hadley's argument concerning rates. In the United States, classification is based on value, and much discrimination is exercised, while in Germany equal mileage rates are almost universal. The systems prevailing in Great Britain, Belgium, and France gradually depart in character from the former and approach the latter. Now, it will be seen, on referring to the table given above, that these countries take exactly the same order with regard to train mileage. Professor Hadley maintains that there is some connection between these facts. There may be, of course. Lastly, some statistics are given on locomotive and car performance, Germany and the United States only being compared. These show, on the whole, an advantage on the side of the United States, which may in part be explained by the larger size of locomotives and cars in the latter country. To estimate the advantage derived from this increased size, it is necessary to know the relative tractive powers of the engines, and their cost, consumption of fuel, etc.

GENERAL.

Lieutenant Frederick Schwatka is said to be preparing for an explorational expedition into the mountains of northern Mexico, which have been so rarely visited.

The Royal Society of Edinburgh has awarded its Makdougall-Brisbane Prize, for the period 1884-86, to **Dr. John Murray**, for his Papers on the Drainage Areas of Continents and Ocean Deposits; the Rainfall of the Globe and Discharge of Rivers; the Height of the Land and Depth of the Ocean; and the Distribution of Temperature in the Scottish Lochs as affected by the Wind—all of which it has been our privilege to publish, with the original illustrative maps.

Early Racial Types.—The casts taken by Mr. Petrie in Egypt show the types of face found among different races as early as the fourteenth and sixteenth centuries B.C. Captain Conder, in the *Quarterly Statement* (July 1888) of the Palestine Exploration Fund, remarks that these casts exhibit five quite distinct types: (1) white, blue-eyed, with light hair; (2) the red Egyptian; (3) the bearded Semitic people, reddish or yellow; (4) the Negro; and (5) the hairless, brown, or orange race, with receding forehead, and a large nose, straight or aquiline. The colours are not to be relied on, for they may in some cases have faded, while on other faces the complexion may be due to painting. The light people appear to be Aryans, and may, perhaps, be represented by the modern Kabyle. If so, the Aryans must have spread through Western Asia earlier than has hitherto been supposed. With regard to the Egyptians, Captain Conder notices a change in type, the heads from a tomb of the sixth dynasty being very different from those of the times of Rameses II. But this change may be due to increased care in drawing. The earlier type strikingly resembles that of the Cappadocian deities, while the latter, aquiline, type is very similar to the Abyssinian. The head of a modern Kirghiz is as like a Hittite as it is possible to conceive. The Philistine (if Pulistha really denotes a Philistine) wears the

same form of head-dress as that worn by the Takrui, the supposed Teucri. In appearance they are not Semitic, but, perhaps, Turanian.

The Races of the Babylonian Empire.—Mr. G. Bertin has contributed a paper on this subject to the November (1888) number of the *Journal of the Anthropological Institute*. As explorations have been carried on more systematically in Assyria, Babylonian representations of faces are scarce, and Babylonian types must be sought for in Assyrian bas-reliefs. Two principal types can be distinguished in reliefs from the latter country : the known Ninevite type, illustrated in the representations of kings and soldiers, and the lower type, belonging to people of inferior condition. The first type shows a long head, straight forehead, and slightly curved nose ; the characteristics of the other are, a small round head, low receding forehead, high cheek-bones, prognathism more or less marked, and, sometimes, a retreating chin. The oldest Babylonian type is to be found on the monuments at Tello, and is styled by Mr. Bertin *Gurian*, from the primitive national name of the Akkadians. The head is round, forehead low and wide, cheek-bones slightly prominent, and the nose large but not aquiline ; the hair is rather curly and the stature medium. The Babylonians of the time of Assurbanipal have a long egg-shaped head, high and wide forehead, nose rather long but straight, lips moderately thick, wavy hair and high stature. The low type found in Assyria is represented also in Babylonian monuments. In Syria two types existed, the ordinary Jewish type and a low type with round head, low forehead, thick lips and frizzy hair. An Arab type also is represented—not the one most familiar to Europeans, but that known as Caucasian. The Armenians closely resemble the Jews, as, indeed, they do at the present day. The low Assyrian race was, no doubt, the primitive race, and it may still be recognised almost all over Europe. The Akkas, described by Professor Flower, exhibit the principal characteristics of this race. The second in order of time was the Semitic—not the Jewish type usually associated with the name, but the Arab type above mentioned, which may still be traced in Arabia. Mr. Bertin proposes to call these two races the *Ground Race* and the *Sinaitic*. The third race is the Gurian, the primitive Akkadians, who invaded the whole of Western Asia, and contributed to form new races, but disappeared as a distinct people. The fourth race Mr. Bertin calls the *Nairic*. It is of the Armenian type, and appears first at the time of Assurbanipal. Through the intermixture of these races arose new types, such as the low Jewish from the admixture of Negro blood, the Hittite by a crossing of the Sinaitic and Ground races, etc.

The Death-Rate as a Test of the Health of a Community.—Statistics are, perhaps, too much relied on at the present day, for they sometimes require the greatest caution in their application. This has been illustrated, in the case of the death-rate, by Mr. R. M. Johnston of Tasmania. Migration affects the ratio of deaths to population, epidemics raise the rate for a short period, and many other causes render the death-rate no absolute criterion of the healthiness of any locality. But the most striking disturbing influence is the relative proportion of the groups of persons of different ages. Death is more common among children and aged persons than among persons from five to sixty years of age. Now, if the first two classes in any community are very numerous compared to the third, it is evident that the death-rate will be high. Thus, in two towns, containing the same number of inhabitants, in which the ratio of the last class to the other two is different, it is quite clear that, if the ratios of the numbers of deaths in each class to the number of persons in the class, is the same in both towns, the death-rate must be higher in the town which contains the larger number of

children and old people, and that the ratios above mentioned may be altered within certain limits without equalising the death-rate. And yet it cannot therefore be inferred that the air is more salubrious, or the sanitary arrangements better in one town than in the other. Colonies—specially young colonies—furnish an example of this problem, for immigrants are, as a rule, young men or women, and therefore the death-rate is low in such countries. On the other hand, the death-rate, as usually calculated, does not show the longevity of the population—an undoubted sign of the healthiness of a locality. Mr. Johnston proposes to obtain a health standard by multiplying the ratios of the number of persons in each group by the death-rate of that group, and dividing the sum of these results by the sum of these ratios. By this means each group will exercise its due influence.—*Papers and Proceedings of the Royal Society of Tasmania*, for 1887.

NEW BOOKS.

L'Indo-Chine française : Étude politique, économique et administrative sur la Cochinchine, le Cambodge, l'Annam et le Tonkin. Par J.-L. DE LANESSAN, etc. Avec 5 cartes. Paris : Félix Alcan, 1889. Pp. 760.

This work contains a fund of useful and statistical information on the whole of that portion of Indo-China which is in French hands, or under French influence. The author gives to the term, 'l'extrême Orient,' a more extended signification than is usually applied to it, making it comprise the whole of India. In discussing the steps by which the various peoples of Eastern Asia arrived at their present stage of social and political evolution, he renders full justice to the wise and beneficent action of the British in India. (By the way, the religion of the Sikhs is not 'une forme spéciale de l'islamisme.'!). He credits us, indeed, with casting longing eyes on Siam—a desire never, so far as we know, expressed by any English writer, and certainly never entertained by any responsible English politician or thinker ; but it is well to see ourselves as others see us. To Englishmen acquainted with the East, the continued independence of Siam seems now more than ever desirable, and the suggestions openly made of late by French semi-official writers, for an extension of French influence over that kingdom, a matter of regret. In this connection, the author's account of an expedition sent for the purpose of 'rectifying' the frontier between Annam and the Siamese province of Luang-Prabang, will be read with interest. After describing the main features of the eastern regions of the Indo-Chinese peninsula, their physical features, rivers, towns, and routes, the author proceeds to give an account of the various populations, of the native industries, of the natural resources and products of cultivation. Speaking of the rice trade, he attributes the difficulty of getting a market in France for this staple (an inferior quality of which is used there in the manufacture of alcohol only) to the dearness of transport. But he disbelieves in the remedy suggested, of a heavy duty in France on foreign rice. Nor would subsidised lines of vessels be of much avail, he thinks, simply because of the small return-demand for French goods. As it is, the preponderance of the trade is, notwithstanding such subsidies, in the hands of foreign vessels, chiefly German, Danish, and English. He

writes very candidly on the financial situation, as also on the political and administrative difficulties. It appears that to cover the cost of the protectorate of Annam, the external customs were taken over by the French, while internal dues are for the most part forbidden ; the result being that, while the native government is put to great straits, the resources of the French administration have to be supplemented from home.

In Tonkin, the writer says, too much is attempted, and, instead of conciliating the literary, *i. e.* influential, class, and utilising them for Government purposes, this class is being systematically suppressed, at the instigation and in the interests of the Roman Catholic missionaries. Without at all disputing the correctness of the writer's views, we must, of course, remember that this is one of the many questions which has two sides.

The Civilisation of Sweden in Heathen Times. By Oscar Montelius, Ph.D., Professor at the National Historical Museum, Stockholm. Translated from the second Swedish edition, revised and enlarged by the Author, by Rev. F. H. Woods, B.D., Vicar of Chalfont St. Peter. With Maps and 205 Illustrations. London : Macmillan and Co., 1888. Pp. xvi. and 214. *Price* 14*s*.

Dr. Montelius is a worthy successor to the great Scandinavian savants (C. J. Thomsen, Sven Nilsson, J. J. A. Worsaae, and B. E. Hildebrand) who have made themselves a European reputation by their archæological studies, especially by their studies of the antiquities and remains of Norway, Sweden, and Denmark belonging to prehistoric ages. The present work is a clear and comprehensive account of southern Sweden in heathen times—that is, from the beginning of the Stone Age down to the introduction of Christianity by Ansgar in the ninth century. It is a mere matter of course that he follows the established division of his subject, and treats of it under the three great headings of the Stone Age, the Bronze Age, and the Iron Age. To fix a chronological landmark for the beginning of the Stone Age is, from the nature of the case, obviously impossible ; the only limit beyond which the beginning cannot possibly go is the Glacial Period. But, though the beginning cannot be precisely determined, the evidence for deciding upon a time at which it probably ceased is stronger and more manageable. Accordingly, Dr. Montelius divides the period of time treated of thus : Stone Age, down to about 1500 B.C. ; Bronze Age, from about 1500 B.C. to 500 B.C. ; Iron Age, from 500 B.C. to the latter half of the eleventh century A.D.

The work of Dr. Montelius is characterised by great erudition, abundance of illustration (pictorial and citative), and painstaking and conscientious industry. His tone is throughout moderate ; and he avoids that bugbear of archæologists, forced and far-fetched theories.

We cannot pretend to enter into anything like a discussion of the great number of topics dwelt upon by the learned writer. All we can afford to do is to advert to sundry separate points that have an especial interest owing to the side-lights they cast for the most part upon geographical knowledge. As to what people inhabited Sweden during the Stone Age, the skulls found in the graves belonging to that period are not very decisive. "Some are very like those of the Laps, but most of them bear a close resemblance to the Swedish skulls of the present day ; which seems to show that a mixture of two different races had at this very early time already taken place. This circumstance, coupled with the fact that no considerable immigration of a new people into Sweden seems to

have taken place after the end of the Stone Age, makes it highly probable that the Teutonic ancestors of the Swedes began to settle in the land from the beginning of the Later Stone Age. The smaller number of skulls of a non-Scandinavian type which occur in the graves of the Stone Age are no doubt relics of the people who dwelt in the country before the Swedish immigration." To the debated question as to how the Bronze Age began in Scandinavia, Dr. Montelius replies that it "was not connected with any great immigration of a new race, but the people of the North learnt the art of working bronze by intercourse with other nations," chiefly of Central Europe and Italy, the paths of commerce doubtless being the same as in the Later Iron Age,—the course of the Vistula and the line of the Rhine and the North Sea. The fact of this intercourse with foreign countries during the Bronze and Iron Ages is borne witness to among other things by numerous coins of Rome and Byzantium, as well as by some of English and of Arabic casting. Dr. Montelius is of opinion that the beautiful bracteates—gold pendants like coins or medals, and doubtless worn as personal ornaments—are peculiar to Sweden, being of native make, and those that are found out of Sweden he considers to have been carried out of the country by the early seafarers. Merely calling attention to his interesting descriptions of the clothing, tillage, and state of living generally of the inhabitants of the Bronze Age, we pause to state more explicitly that he has given a most admirable account of Sweden and its inhabitants during what is known as the Viking Age (pp. 142 onwards). One fact he emphasises which may seem strange and at variance with our current traditionary notions with respect to the vikings—namely, that they were not all addicted to an adventurous and roving life, but that "pasturage and tillage furnished then, as now, the most important means of subsistence," and therefore, by inference, the chief occupations of the people.

The translator has performed his work very creditably, his version being in smooth and for the most part idiomatic English. In conclusion, a word of praise, and warm praise, for the woodcuts, which considerably enhance the value of a valuable book.

Transactions of the Gaelic Society of Inverness. Vol. xiii., 1886-87. Inverness: *Northern Chronicle* Office, 1888. Pp. xiv. + 372.

The Gaelic Society of Inverness is to be congratulated on the amount of substantial and valuable work done by its members, as recorded in this handsome volume. The aims of the Society are evidently wide in their scope, and embrace many subjects having a distinct geographical bearing. Mr. John Mackay contributes a thoughtful paper on "Sutherland Place-Names," and has been successful in pointing out what seem very probable derivations of several names of districts in that county which have long puzzled those who take an interest in such matters. For instance, his derivation of "Golspie" appears to be most probable, as will be admitted by those who know the physical features of the neighbouring country; on the other hand, his explanation of the meaning of "Cyderhall" seems to be strained, and we prefer the old legend, founded on historical fact, which takes it to have been originally "Sigurd's Haugh." Mr. Bain has a learned paper on "The Clava Cairns and Circles" which contains matter of archæological interest. His description of these remains is clear and accurate. Sir Kenneth S. Mackenzie contributes a valuable article on the Reports on Highland Parishes, 1749. These reports were the forerunners of Sir John Sinclair's "Statistical Account," and, doubtless, suggested to him the idea of that work. It is rather amusing to note how many of the reporters—the parish

ministers—complain of the expense of their fuel, when they were almost literally smothered amid peat. The Provost of Inverness treats of "The Picts" at considerable length; his opinions are well worth comparing with those of Grant of Corriemonie. Mr. Colin Livingstone discourses on "Lochaber Place-Names." The frequent changes in Highland place-names—changes not as a rule for the better—are illustrated by the case of the village of Fort-William, which, since the building of the fort, has been known as Maryburgh, Gordonsburgh, and, finally, by its present designation. The Celts had a rare faculty for giving appropriate and, generally, pleasant-sounding names to the districts which they occupied, and these ought to be preserved wherever possible. The only other paper of a geographical nature is that by Mr. Alexander Ross on "The Caledonian Canal and its effects on the Highlands"; it contains some interesting information.

The Tour of Dr. Richard Pococke, Lord Bishop of Ossory, through Sutherland and Caithness in 1760, with Introduction and Notes by Daniel William Kemp. Printed at the Darien Press. Published by The Sutherland Association. Edinburgh, 1888.

The Sutherland Association is evincing considerable public spirit in publishing a series of memoirs regarding the county in which it is specially interested, and it is to be hoped it may meet with sufficient encouragement to warrant the issue of more ambitious works than the two already before the public. It is well known that the Duke of Sutherland possesses manuscripts of almost priceless value relating to the county, and it would not, we should imagine, be at all difficult to obtain his consent to the publication of a portion of them. Such a work would be of value, not only to the Association, but to all interested in the history, antiquities, and genealogies of Scotland.

The present issue consists of a part of the tour of Bishop Pococke, already published in full by the Scottish History Society. It must be confessed that the worthy Churchman was no keen observer, or judicious recorder of facts. The matter of dinner outweighed most considerations, and his entertainers, as the editor notes, come in for all sorts of gracious acknowledgments, while those who supplied him with information have to go without a word of thanks. This is especially noticeable in the case of the Rev. Mr. Pope of Reay, one of the ripest scholars, and perhaps the greatest antiquarian authority of his time in the north of Scotland. The Bishop, however, was a thorough traveller; he remarks upon the difficulties and dangers of travelling in the Highlands at the period, but regards them as matters of course. We are afforded, in the course of the narrative, some interesting notices of the way in which the Highlanders then lived; the description of a crofter's home (at p. 7) may, with advantage, be perused and reflected upon by those who have, of late years, been conspicuous throughout the Highlands by their words more than by their deeds. The Bishop was no draughtsman, yet his sketches are interesting as affording a better idea of several buildings, as they were before falling into entire decay, than we could otherwise have. This is especially true as regards Castles Sinclair and Girnigoe, now an almost shapeless mass of mingled ruins.

The editorial part of the work has been carefully done, and the notes are certain to prove of considerable value to future students of the history and antiquities of Sutherland and Caithness. Small as the book is, an index would have been an advantage, and a sketch-map of the two northern counties, with

Dr. Pococke's routes indicated, would have proved a decided help to those who are unacquainted with the district.

Sketches from a Tour through Holland and Germany. By J. P. Mahaffy and J. E. Rogers. London: Macmillan and Co., 1889. Pp. xv. and 271. *Price* 10*s.* 6*d.*

This book, the outcome of a holiday trip, by certain scholarly gentlemen whose style betrays a strong flavouring of university culture, is written in a racy, humorous style, with a plentiful sprinkling of illustration from the censers of learning. But it is not a learned book, in the sense that it is thickset with erudition, with elaborate architectural or archæological discussions, or no less elaborate criticisms of works of art. The authors call it an "idle book;" and with the recollection of their deprecatory preface in our mind we cannot, in all conscience, speak harshly of it, even though we found, which we have not, anything that calls for severe censure. Our fault-finding must be limited to one thing: the book is not improved, to our judgment, by the disquisition on modern German politics (the Sir Morell Mackenzie controversy, etc.) which occurs towards the end of it. Turning to the other side of the reviewer's conto-book, we could wish for more of their jottings on such topics as the sleepy, old-world towns of the Zuyder Zee and the little-visited towns of Germany—Fulda, Helmstedt, Hildesheim, Marburg, Greifswald, Stralsund, Rostock, Wismar, etc. Their bright gossipy comments, their keen observations, their love for out-of-the-way bits of valuable architecture and out-of-the-way turns and phases of human life are such as will please the reader who wishes for an evening's recreation, especially if he happens to know the regions sketched. The illustrations are on the whole fairly well done. But the price of the book is surely too restrictive for a mere "idle book."

The Land of Rubens: A Companion for Visitors to Belgium. By Conrad Burken Huet. Translated from the Dutch, and edited by Albert D. Vandam. London: Sampson Low and Co., 1888. Pp. 232. *Price* 3*s.* 6*d.*

A pleasant companion to the artist or the student of Flemish art who is making a tour in Belgium, but too disconnected to be of service as a guide-book. As the book was originally written for Dutch readers, the translator and editor has, as he states in his Preface, been obliged to omit passages that would have been incomprehensible to the average English reader; and perhaps it is due to this that the book seems lacking in proportion.

Switzerland: its Mountains, Valleys, Lakes, and Rivers. With 250 Illustrations. New and revised edition. London: J. S. Virtue and Co., 1889. Pp. 388. *Price* 15*s.*

The present volume is quite equal to any in this popular series. It is well written and arranged. Without partaking too much of the treatment of a guide-book, the subjects selected for description are chosen with taste. The writer shows his cognisance of geography, and is not guilty of serious blunders, such as are too often met with in books equally popular in their scope. In places, however, he gives himself too much latitude in personal reflections, and, considering the value of his space and the wealth of his subject, in unnecessary digressions. The illustrations are very good, and give a capital idea of the scenery of Switzerland.

A Winter in Albania. By H. A. Brown; Illustrations by C. H. Brown. Pp. viii. and 395. London: Griffith, Farran, Okeden, and Welsh. 1888. *Price* 10*s.* 6*d.*

This book is already partially known to the public through the columns of the *Globe* newspaper, from which some portions have been reprinted. It is interesting, inasmuch as not many descriptive works have been written regarding Albanian scenery, and very few authors could describe its winter characteristics from such intimate personal experiences as those encountered by Mr. Brown. He writes easily, and recounts his many curious adventures with a keen sense of humour which will serve to popularise his book. Judging from the author's narrative, the character of the native Albanian is not of a very high type, hazy notions prevailing with respect to the laws of *meum* and *tuum*. The accounts given as to the legal administration of the officials of the Sublime Porte are highly amusing. The book contains illustrations, giving a fair idea of scenery and native costumes.

Naples in 1888. By E. N. Rolfe and H. Ingleby. London: Trübner and Co. *Price* 7*s.* 6*d.* Pp. 262.

Rarely do we find a city and its inhabitants so carefully described as in this volume. Its authors point out the curious survivals of the Spanish and French occupations in the language of the people. As to the industry of Neapolitan fishermen, the authors consider the Bay of Naples "the best-fished waters in the world." The Neapolitans are notoriously of a fiery and excitable temperament. When one of them gets exceptionally enraged, his friends sometimes send for the barber, who bleeds him! The Neapolitan's propensity for cheating, and his addiction to bribery, are also remarkable. Superstition likewise is widespread. Nearly every animal has at least one amulet attached to its harness to preserve it from ill-luck. The people themselves wear amulets to preserve them from the Evil Eye. The truth is, that ignorance widely prevails. "The professional and commercial classes won't read, the working classes can't read, and the upper classes, if they read at all, devour French novels, which certainly are not written by their confessors." The majority of South Italian priests come from the peasant classes. As to Secret Societies, they are now very different from what they once were. Still, the Freemasons are a political body, and control the municipal elections. They are Anti-clerical and Radical. The lower classes have still their Camorra, which is a system of blackmail and boycotting. Gambling is the most popular recreation of the Southern Italian. The net revenue derived by the Italian Treasury from Government lotteries was, from 1871 to 1887, eighteen and a half million pounds sterling, which shows that such lotteries have been one of the most stable of Italian industries. In the province of Naples alone fifty-five millions of lottery tickets, of the average value of about 3d. each, were sold in the single year ending June 1887.

The First Ascent of the Kasaï, being some Records of Service under the Lone Star. By Charles Somerville Latrobe Bateman, sometime Captain and Adjutant of Gendarmerie in the Congo Free State. With 57 Illustrations and 2 Maps. London: George Philip and Son, 1889. Pp. 185. *Price* 21*s.*

Mr. Bateman required to make no apology for publishing this narrative of his journey up the Kasaï. It gives a good deal of original information in regard to this fine waterway, and more especially concerning the Bashilangé-

Baluba people, whose country is situated in the triangle made by the confluence of the Sakuru with the Kasaï. As regards the Kasaï itself, we have already referred extensively in our Geographical Notes, and in our review of Wissmann's book, to the exploration of the river. Sir Francis de Winton, in a recent paper, informed us of the return to their country of the faithful Baluba, under their king Calemba, who had accompanied the German expedition down the Kasaï to the Congo. Dr. Wolf, Wissmann's lieutenant, took charge of this generous expedition of the Congo State, and Mr. Bateman was second in command. Of its adventures and experiences on the way we need not speak, though, for those who have not read Lieut. Wissmann's book, a certain amount of information is to be obtained from Mr. Bateman's remarks regarding the river and the tribes on its banks. Incidentally, Mr. Bateman, who had previously been a resident on the West Coast, gives us some curious information in regard to "the covert slave-trade carried on by the Angolese subjects of Portugal," drawing a careful distinction between slave-owning and slave-trading, the former being an apparent necessity in the present state of Africa.

The illustrations form a special feature of the book, which is admirably produced. They are from the original sketches of the author, and comprise five chromo-lithographs, six capital etchings, and a large number of engravings. The maps are one of Luebo station, which the expedition founded, and a general map showing the author's routes.

The Least of all Lands: Seven Chapters on the Topography of Palestine. By William Miller, C.I.E., LL.D., Principal of the Madras Christian College, and Fellow of the University of Madras. London: Blackie and Son, 1888. Pp. 247.

These seven chapters on the topography of Palestine present us with an admirable account of the influences which the physical features of their country exercised upon the people of Israel and upon their history. The work was carefully prepared for, the author's journey through "the least of all lands" having been no mere tourist's trip, but an honest and painstaking survey which, if it did not embrace the whole of Palestine, has led to results such as to make us wish it had. The importance of physical environment upon a nation has long been admitted, although little has been done to bring examples and discussions of the matter before the reading public. The example set by Principal Miller is an admirable one, and deserves to be followed up. If such were done, it would tend very decidedly to arouse and stimulate an interest in geographical science. The book is most suggestive. The maps are not successful examples of cartography, but in everything else the volume is well produced.

The Statesman's Year-Book for 1889. Edited by J. Scott Keltie, Librarian to the Royal Geographical Society. Twenty-sixth Annual Publication. London: Macmillan and Co., 1889. *Price* 10*s.* 6*d.*

With the year 1889 comes the twenty-sixth edition of the *Statesman's Year-Book*. This excellent compilation has now so thoroughly received the imprimatur of public approval that little can be said in the way of review. The present edition, so far as we have had the opportunity of testing it, maintains the high standard of accuracy, comprehensiveness, and lucidity reached by its predecessors. Including the index, it now extends to 1004 pages, but is withal so well printed, that it continues as of yore an extremely compact and handy volume.

The changes which have taken place in the affairs of the nations during the past year have been duly noted. In this respect the duties of the editor have been by no means a sinecure. A comparison with the *Year-Book of* 1888 will show that his statement in the prefatory note to this edition, that "almost every page has been more or less renewed" is thoroughly justified. A considerable amount of new information is given regarding the empires of Germany and Austria, and, if we may so call it, the empire of India. Egypt also is dealt with in a more complete manner than was the case in preceding editions.

We have almost nothing in the way of criticism to offer. We notice that at page 211, when the House of Lords is dealt with, there is no reference to the statute creating life peers in 1876. Occasionally the arrangement of subject-matter under each country is not altogether on a uniform plan. Thus while some information is given about the division of France for judicial purposes, we do not observe any similar statement regarding the judicial system of Germany. Under "Servia," some reference to the Kara-Georgevitch dynasty, which preceded the Obrenovitch, would be proper. The statement given is misleading. Prince Alexander Kara-George, who became ruler of Servia in 1842, occupied the throne till after the Crimean war. Among the non-official publications containing statistical and other information relating to the United Kingdom, we miss a reference to the valuable Essays on Local Government published by the Cobden Club in 1875 and 1880, under the editorship of Mr. Probyn. A slight misprint in the citation of Professor Gneist's book on page 316 should be corrected. But these are trivial details, and, were it not that the book is a perfect model of accuracy, would not be worth noticing. The set of statistical tables prefixed to the present edition will be found very serviceable.

Commercial Geography: based on the latest Researches and Statistical Returns. A complete Manual of the Countries of the World, their chief Centres of Trade and Means of Communication, their Natural Productions, Mineral Resources, Exports, Manufactures, etc. By Dr. Carl Zehden, Professor in the Handels-Akademie of Vienna. Translated by Findlay Muirhead, M.A. London: Blackie and Son, 1889. Pp. 592.

This volume hangs out a flourishing bush in its title which raises a suspicion that the good wine of the Austrian author has suffered a little by emptying from vessel to vessel. The manual is indeed fairly complete, and the statistics are tolerably recent; but the whole is ill-balanced. The translator's preface informs us that the author is alone to blame for giving Austria-Hungary 44 pages of description, Germany 50, the United Kingdom 35, the United States 30. The result is complete distortion and even inversion of the relative commercial importance of English and German-speaking countries.

The first sixty-eight pages deal inadequately with mathematical and physical geography; they should be either extended considerably or abridged to a few paragraphs of correct definitions. In this section there are errors of editing, such as the statement that the Arctic night lasts from March to September, and many confused statements. We are told, for example, that "Comets are stars which appear at intervals on a fixed horizon and then again disappear."

The rest of the book, which is devoted to the countries of the world with special regard to their trade and products, is very well done, although a different allocation of the space would be more profitable for English readers. The statistics are numerous and trustworthy, and the translator has added a series

of valuable notes of which there should be more, as he appears to have respected the author's text unduly. The whole of page 375, for example, turns on the use of slave-labour in Cuba, and contains predictions as to what will happen on emancipation. The translator might have added a foot-note here: "Slaves emancipated 1886"—but no notice is taken of this important fact.

The treatment of the United Kingdom, India, and the colonies is decidedly the worst in the book. The arrangement is unsatisfactory, and there are many small errors. The statement, "In 1886, 44,000,000 tons of coal were imported into Great Britain . . . 37,000,000 tons were exported" is of course a mere slip; coal probably taking the place of "goods;" but the size of Heligoland is deliberately given as one-third of a square mile in several places, which is all the harder for that small possession, as its area is really only three-quarters of a square mile. The list of the chief towns of Britain is arranged alphabetically in counties, and full of anomalies: for instance, Barrow is omitted in Lancashire, Stornoway is omitted in Ross-shire, while Bridge-of-Allan figures as a "chief town" in Stirlingshire. Next in incompleteness comes "The United States of *North* America" as the translator continually names it.

It is a pleasure to turn to the good points of the book. All the exports and imports of countries are given consistently in pounds sterling. The manner in which the continental European countries are described leaves little to be desired. The influence of configuration and climate on the distribution of productions, and the influence of national character on the conduct of trade are always kept in sight, and give unity and great impressiveness to the pictures of each country. Hence this *Commercial Geography* seems destined to do good work in English, though probably it will never be such a success as is the original work. An idea of the manner in which Mr. Muirhead has succeeded in the difficult task of translating a technical German book into graceful English, is given by the opening paragraph on the manufactures of France:—

"France is the second manufacturing country of the globe, and the only one which rivals Great Britain. In some points, indeed, as, *e.g.* in taste and form, it excels the latter. The manufacturing industry of France is indebted for this lofty position to the great natural wealth of the country, the splendid means of communication, the inventive genius of the people both in technical and æsthetic matters, the energetic assistance of the Government, and the abundance of capital. It is fostered also by seventy-five chambers of commerce, and by commercial tribunals, besides numerous mercantile associations and excellent technical and trade schools. Art and industry are united in France in a manner unparalleled elsewhere. The sense of beauty which is innate in the French as a nation, is encouraged and cultivated by institutions like the 'Ecole Centrale des Arts et de Manufactures' and the 'Conservatoire des Arts et Métiers,' and by schools of design, exhibitions, premiums, etc. For centuries the French have held an undisputed position as the 'glass of fashion and the mould of form' for all other nations."

The Colony of New Zealand: Its History, Vicissitudes, and Progress. By William Gisborne. London: E. A. Petherick and Co., 1888. Pp. 360. *Price* 7*s.* 6*d.*

As Mr. Gisborne was formerly a Member of the House of Representatives, and a responsible Minister in New Zealand, he speaks with some authority. His book is at once concise and complete. After a sketch of the physiography, geology, zoology, and botany of New Zealand, he describes the Maoris,

a race which, he says, "had implanted in it germs of high qualities and of great capacities." Then he traces the history of the colony to the present date. After this, we come to the actual position and prospects of New Zealand, a colony which has been rather unfortunate of late. Mr. Gisborne quotes Sir Francis D. Bell and Mr. Mulhall to show that among the greatest of the resources of New Zealand is the export of frozen meat to the United Kingdom. Mr. Mulhall thinks New Zealand could easily send us about 100,000 frozen sheep monthly—say 30,000 tons of meat per annum, or five per cent. of the deficit that Great Britain must cover by importation from abroad.

Mr. Gisborne dwells at some length on the change which took place in New Zealand during the ten years which immediately followed 1870, for two reasons: first, because it was during that decade that New Zealand made its greatest progress in colonisation; second, because the policy of large borrowing for purposes of colonisation in New Zealand was then first practically initiated, and has left consequences, of a mixed character and still actually at work, which cannot be disregarded and should be understood. He remarks:—"While, on the one hand, it must be admitted that the burden of debt is very great" (£35,196,000, at 31st March 1888, carrying with it an annual charge of about £1,767,200), "and that the policy of seeking relief merely by its further extension would be suicidal; still, on the other hand, it should be borne in mind that the practical advance which New Zealand has made in industrial wealth is almost unprecedented, and that its resources, in course of development and others as yet inactive, are enormous. Its reserve of material strength is almost immeasurable. What is needed is retrenchment of all unnecessary expenditure, wise administration, and encouragement of settlement and sound progress."

Some excellent maps by W. and A. K. Johnston accompany the volume, including one of Taupo volcanic zone, and another illustrating the Tarawera eruption, on 10th June 1886, which destroyed "those masterpieces of Nature's handiwork, the Pink and White Terraces," and which formed a fissure nearly nine miles long, and from 300 to 900 feet deep.

The Northern Counties Red Book: Inverness, *Northern Chronicle* Office.

This little handbook for the North Highlands contains a mass of historical and statistical matter, besides official lists for every parish, and will prove of use to those who have business to transact in the northern parts of Scotland. The information given is succinct and well arranged.

Durch Bosnien. Von Svetozar Boroevic'. Wien: Buch und Kunstdruckerei "Stegermühl."

This is a practical guide through Bosnia, evidently got up by the railway companies. Although patchy, it may be found of more real service to the traveller than many more pretentious guides. The illustrations are capital and the map is excellent. Since the occupation of the country by Austria-Hungary, Bosnia has become better known and more accessible to the tourist, but it is by no means as well known as it deserves to be.

The Florida of To-day: A Guide for Tourists and Settlers. By James Wood Davidson, A.M. Pp. 254; with Maps and Illustrations. New York and London: D. Appleton and Co., 1889. *Price* 5*s.*

We have here, within the compass of a pocket volume, a concise account of the State of Florida, which should prove interesting to all. It is divided into

twelve chapters, each with its distinctive title, such as History, Geography, Climate, Geology, Population, etc., and these again are sub-divided into sections, the subjects of which are also detailed in the Table of Contents.

In Chap. IV., under the heading of Divisions, we are informed that, "There are three Floridas, three climates, and three hygienic problems involved," and a small sketch-map is introduced, showing the state divided into Northern, Semi-tropical, and Sub-tropical Florida, the difference in climate being in a large measure due to the influence of the Gulf Stream. Official statistics and authorities are quoted to indicate the healthiness of the country, from which it would appear that the reports as to the prevalence of malarial fevers have been often exaggerated and misleading. A statement regarding the products of Florida occupies nearly one-third of the book, indicating a very great variety. For the other aspects of this part of the United States, we must refer the reader to the book itself, which has, in addition to the useful table of contents already mentioned, a good index and a serviceable map, besides an appendix giving railway and river routes, and a list of the hotels open as winter resorts.

A Guide to Trinidad: A Hand-book for the use of Tourists and Visitors. By J. H. COLLENS, Port of Spain. Second edition. London: Elliot Stock, 1888. Pp. 287. *Price* 6*s.*

Mr. Collens is a resident of Trinidad of twelve years' standing, so that his book is the result of lengthened experience. In it he discusses everything likely to interest visitors to "the lovely island of Trinidad." He estimates its total population at about 180,000, the town of Port of Spain containing 39,000. The climate of Trinidad is, in his opinion, very salubrious, "the draining of swampy lands and the formation of roads, thus encouraging the clearing and planting out of the country districts, together with proper sanitary regulations strictly enforced in the towns," having removed the causes of disease to which Europeans formerly were liable. Early in June the wet season usually begins, and lasts for about five or six months. On an average 65½ inches of rain fall annually, August being generally the wettest month. Earthquakes are slight, and violent storms are rare. He thinks Trinidad, with its many natural advantages, will yet become a favourite winter-resort for Europeans and Americans. Immigrants from the Indian Empire comprise about one-third of the population; and these coolies, "though mostly labourers and small shopkeepers, managed to deposit in the Government Savings Bank the sum of £49,254 during the year 1887." As for the Creole lower class, their most universal failing is the absence of thrift. They are not particularly honest, and they are decidedly immoral. At the same time, they are very polite, and have musical tastes. Their language is a strange mixture of English and French. Mr. Collens' book is pleasantly written; it would have been more complete if it had been furnished with a map.

Making a Start in Canada: Letters from Two Young Emigrants. With an Introduction by Professor ALFRED J. CHURCH, M.A. Pp. xx. and 224. London: Seeley and Co., 1889. *Price* 2*s.* 6*d.*

This is a very practical little book, which may serve a twofold purpose. It will convince idle malcontents here that colonial out-door life is not the free-and-easy business they are too ready to suppose, and it also evidences what may be done by young, strong hands from the mother-country in a land where pluck and perseverance are essential to success. Professor Church has published extracts from the letters of his two sons, who left England for Canada in 1886, their respective ages being only about 18 and 17.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

LETTER FROM MR. STANLEY.

[*The following letter from Mr. Stanley was addressed to the Royal Geographical Society of London and the Royal Scottish Geographical Society, and was received in London on 1st April* 1889.]

Mariri Rapids, Ituri River, Central Africa,
1st September 1888.

I TAKE advantage of the portage now being conducted overland along these rapids to give you some geographical details of the new land lately traversed, and now about to be re-traversed, by us.

Yambuya, our entrenched camp, is in N. lat. 1° 17′, and E. long. 25° 8′.[1] The objective point of the expedition was Kavali, in N. lat. 1° 22′, E. long. 30° 30′. In a direct line the distance is 322 geographical miles. Until we penetrated and marched through it, this region was entirely unexplored, and not trodden by either white or Arab. For the purposes of this expedition we should have wished to have known something of it, but we could glean no information respecting the interior, because the natives were so wild and shy of all strangers.

Having selected my officers and men, my force numbered 389 rank and file. The rest of the expedition was left at Yambuya until the rear column could be collected from Bolobo and Stanley Pool. We carried a steel boat, 28 feet by 6, with us, about three tons of ammunition, and a couple of tons of sundries, provisions, etc. With all these goods and baggage we had a reserve force of about 180 supernumeraries; half of them carried, besides their Winchesters, bill-hooks to pierce the bush and cut down obstructions. This band formed the pioneers—a most useful body.

The path leading from Yambuya was tolerable only for about five miles; we were then introduced into the difficulties which more or less would impede our movements, and arrest rapid progress. These consisted of creepers, varying from one-eighth of an inch to 15 inches in diameter, swinging across the path in bowlines or loops, sometimes massed and twisted together; also of a low, dense bush occupying the sites of old

[1] Mr. Stanley gives the longitude of Yambuya at 25° 8′, which does not agree with our map.—EDS.

clearings, which had to be carved through before a passage was possible. Where years had elapsed since the clearings had been abandoned, we found a young forest, and the spaces between the trees choked with climbing plants, vegetable creepers, and tall plants. This kind had to be tunnelled through before an inch of progress could be made. The primeval forest offered least obstruction, but the atmosphere was close, stagnant, impure, and an eternal gloom reigned there, intensified every other day by the thick, black clouds charged with rain,—so characteristic of this forest region.

We camped at Yankonde, a populous settlement opposite rapids, on the first day of departure, the 28th June 1887. Along the river bank no path could be found; besides, the river wended too much to the north-east for the course I proposed to take. We therefore cut a path through the manioc fields, and came upon a travelled road leading from village to village inland. In a few days we became fully initiated into the subtleties of savage warfare. Every art known to native minds for annoying strangers was practised by these natives; the path frequently had shallow pits filled with sharpened splinters, or skewers, deftly covered over with large leaves. For bare-footed people this proved a terrible punishment. Often the skewers would penetrate the feet quite through; at other times the tops would be buried in the feet, resulting in gangrenous sores. We had ten men lamed by these skewers—so efficiently lamed that few of them recovered to be of much use to us. One of the approaches to every village was a straight road, perhaps 100 yards long, and 12 feet wide, cleared of jungle, but bristling with these skewers, carefully and cunningly hidden at every place likely to be trodden by an incautious foot. The real path was crooked, and took a wide detour; the cut road appeared so tempting, so straight and so short. At the village end was the watchman to beat his drum and sound the alarm, when every native would take his weapons and proceed to the appointed place to ply his bow at every opportunity. Yet, despite a formidable list of hostile measures and attempts, no life was lost, though our wounded increased in number.

After a few days of this work the path became an elephant track, leading SE., S., and SW. We again changed our course. By compass we found a path leading NE. and E.; and on the 5th July touched the river again. Being free of rapids, apparently, I lightened the advance column of the steel boat and forty loads. The boat proved invaluable. She not only carried our cripples and sick, but also nearly two tons of food. From July 5th to the middle of October we clung to the river. Sometimes its immense curves and long trend NE. would give me sharp twinges of doubt that it was unwise to cling to it; on the other hand, the sufferings of the people, the long continuity of forest, the numerous creeks, the mud, the oppressive atmosphere, the perpetual rains, the long-lasting mugginess, pleaded eloquently against the abandonment of the river until N. lat. 2° should be attained. North lat. 2° I put down as the limit. I would prefer to dare anything than go so far north. In favour of the river was also the certainty of obtaining food. Such a fine broad stream as this, we argued, would surely have settlements on its banks; the settlements will furnish food, by fair means or force.

G. Philip & Son, London.

*** Mr. Stanley enclosed in his letter a rough sketch-map of his route from Yambuya to the Albert Nyanza, which has been combined in the above with our existing information.

The river retained a noble width, from 500 to 900 yards, with an island here and there, sometimes a group of islets—the resorts of oyster fishermen. Such piles of oyster shells! On one island I measured a heap 30 paces long, 12 feet wide at the base, and 4 feet high.

Such a land for flies, insects, and butterflies! The butterflies congregate around me as I write this letter, and flap their wings in approval of this statement. There are clouds of the latter sailing daily up and across stream, which last for hours.

At almost every bend of the river, generally in the middle of the bend—because a view of the river-approach up and down stream may be had—there is a village of cone huts of the candle-extinguisher type. Some bends have a large series of these villages populated by some thousands of natives. The villages of Banalya, Bakubana, and Bungangeta tribes run close to each other along a single long bend. The first has become famous through the tragedy ending in the death of Major Barttelot. An island opposite the site of the Bungangeta villages I occupied to re-organise the expedition, which had almost become a wreck through the misfortunes of the rear column.

The abundance found by us will never be found again, for the Arabs have followed my track by hundreds, and destroyed villages and plantations; and what the Arabs spare the elephant herds complete. Internecine conflicts of native tribe against native tribe have also taken place; at least, numerous old clearings and stockades along the river-fronts of the villages suggest this. So many were there, that a large expedition could have been supported by the fields of manioc, to which no owner seemed to lay claim.

On the 9th July we came to the rapids of Gwengweré,—another populous district. Near here I saw a stratum of oyster shells covered with 3 feet of alluvial soil. How many scores of years have elapsed since the old aborigines fed on these bivalves?—I should like to know; and what was the tribe's name?—and where, if any exist, is the remnant? For waves of wild peoples have come and gone over this land, as over other lands. Indeed, these villages, though so close together, shelter many different tribes of men. At Gwengweré Rapids, for instance, there are the Bakoka, Bagwengweré, and, a little higher up, are the Bapupa, Bandangi, and Banali. The tap of a drum alarms all. Inland are the Bambalulu and Baburu, the latter of whom is spread out over a considerable region. The Baburu call the river "Suhali."

The mornings generally were stern and sombre, the sky covered with lowering and heavy clouds; at other times a thick mist buried everything, clearing off about 9 A.M., sometimes not till 11 A.M. Nothing stirs then: the insect life is still asleep; the forest is still as death; the dark river, darkened by lofty walls of thick forest and vegetation, is silent as a grave; our heart-throbs seem almost clamorous, and our inmost thoughts loud. If no rain follows this darkness, the sun appears from behind the cloudy masses; the mist disappears; life wakens up before its brilliancy; butterflies skurry through the air; a solitary ibis croaks an alarm; a diver flies across the stream; the forest is full of a strange murmur; and somewhere up river booms the alarum drum,—the quick-sighted natives have

seen us; voices vociferate challenges; there is a flash of spears, and hostile passions are aroused.

On the 17th of July 1887, we camped at this very place, where I now write this letter on the 1st September 1888, or 13½ months ago. Beyond Mariri Rapids is a large settlement on the south bank called Mupe; there is another portion of the same tribe located a little higher up on the north bank. Up to this place there is no decided fall of water; the rapids are caused by reefs of rock through which the river has channelled passages, where the current is like that of a sluice. Conveying as we do such stores of ammunition and baggage, there is a delay of perhaps two days at each rapid, for we have to carry the baggage overland, and either pole or haul the canoes through the rushing currents.

The next rapids are those near Bandeya, which we reached on the 25th of July. Between Mariri and Bandeya Rapids are located the Balulu, Batunda, Bambwa; and at the last rapids are the Bwamburi. Inland, to the north, are the Babua; and the Mabode occupy the region further east. To the south are the Bundiba peoples, the Binyali, and Bakongo.

Peace among the river tribes is signified by tossing water upwards with the hand, or paddle, and letting it fall on their heads. If we were to believe them, the natives all suffered from famine. There was no corn, nor bananas, nor sugar-cane, nor fowls, nor goats, nor anything else. Exhibition of brass wire, cowries, or beads, had no charm for them—because, since they had no food, such kinds of currency were unavailable. We had surely all died from want had we been so simple as to believe them. In every attempt to barter we suffered from the cunning rogues. A brass rod only purchased three ears of corn; in a short time a fowl rose to five brass rods. To live at all, we had to take what we could, for our would-be friends were our worst enemies, because they aided a constant enemy to us—hunger.

At a place called Mugwye's,[1] above the rapids of Bandeya, there is a cluster of seven villages backed by plantations of bananas and manioc fields miles square. An entire day was spent by us pleading, begging, expostulating, and bartering at terribly dear prices. About a third of the people had received about three heads of corn each for their cowries and brass rods. The shamefulness of this you will better understand when I tell you that at Bangala, 800 miles nearer the Ocean, a brass rod purchases ten rolls of cassava bread, and three cowries purchase about fifty bananas, etc. Here, a brass rod ought to have purchased twenty rolls of bread, or two large bunches of bananas. Well, we went over in the boat and canoes, and helped ourselves, and prepared food for the nine days' wilderness ahead of us.

Four days' march above Mugwye's, we came to Panga Falls—a decided fall of 30 feet—in the centre. The people here tried to cozen us also, but, as life could not be sustained with empty words, our intercourse was but short. Above Panga, the rapids become more frequent; there is Nejambi, and Avugadu, and, a day's paddling above the latter, we came to the settlement of Avejeli,[2] opposite the cataract by which the Nepoko, 300 yards wide, tumbles into the Ituri, or Aruwimi.

[1] Nuswye's (?)—Eds.

[2] Air Jedi (?)—Eds.

We gain but little information from natives with whom we establish friendship; they are too suspicious and prone to lying; our best sources are those we succeed in capturing. After a day's experience of us they recover their equanimity, and impart readily what they know, or at least as much as we can understand of their languages. There was a stout, well-built native captured at Mugwye's. He reported to us, that there was a huge lake to the ESE. called Nouma, or Uma; it would be found where the Nepoko and No-welle join and become one. It took a native two days to cross the lake. There was a large island in the middle full of terrible serpents. I was anxious to see this lake—for I looked upon it as a means of lightening our labours. A waterway taking us 100 miles—or even 60 miles east—would be invaluable to us. Road-cutting and hundreds of obstacles met in forest marching would be done away with. Some of the terrible serpents we would secure in some way as specimens. The native was so precise as to locality, that we believed him; but, two days from Avejeli, our guide escaped, and his story turned out to be a fable, for we never heard more of the Nouma, or of any other lake while in the forest region.

Nejambi Rapids marks the division between two different kinds of architecture and language. Below, the cone huts are to be found; above the rapids, we have villages long and straight, of detached, square huts, surrounded by tall logs, which form separate courts, and add materially to the strength of a village. Defended by rifles, such villages would require a large power to capture. The walls of the huts are jealously screened with logs also. We found, after a few days' experience among them, that the natives have been compelled to adopt these many precautions against the poisoned arrows in use throughout the region. At Avisibba,[1] about half-way between Panga Falls and the Nepoko, the natives attacked our camp, in quite a resolute and determined fashion. Their stores of poisoned arrows, they thought, gave them every advantage: and, indeed, when the poison is fresh, it is most deadly. Lieutenant Stairs and five men were wounded by these. Lieutenant Stairs' wound was from an arrow the poison of which was dry; it must have been put on some days before. After three weeks or so he recovered strength, though the wound was not closed for months. One man received a slight puncture near the wrist; he died from tetanus five days later. Another received a puncture near the shoulder, in the muscles of the arm; he died six hours later than the first case—of tetanus also. One was wounded in the gullet—a slight puncture—he died on the seventh day, I believe; one wounded in the side died at night the same day. Tetanus ended the sufferings of all. We were much exercised as to what this poison might be, that was so deadly. On returning from the Nyanza, to relieve the rear-column under Major Barttelot, we halted at Avisibba, and, rummaging among the huts, found packets of dried red ants (or pismires). It was then we knew that the dried bodies of these, ground into powder, cooked in palm oil, and smeared over the wooden points of the arrows, was the deadly irritant by which we lost so many fine men with such terrible suffering. Now we wonder that we have been so long in

[1] Air Siba (?)—Eds.

the dark, for we could create any number of poisons from such insects as we have seen. The large black ant, for instance, whose bite causes a great blister, would be still more venomous prepared in the same way. The small grey caterpillars would make another irritant, which, mixed with the blood, would torture a man to death; the bloated spiders, an inch in length, which are covered with prickles most painful to the touch, would form another terrible compound—the effects of which makes one shudder to think of. These poisons are prepared in the woods. In the depths of the forest, the savage makes his fire, and prepares the fatal venom, which lays low even the huge elephant. It is forbidden to cook it near a village. In the forest he smears his arrows, and, having covered the points with fresh leaves, lest he himself might be a victim, he is ready for war.

I could write a book, almost, upon the various species of bees, found in this forest-region; and several books might be written about the multitude of curious insects we have seen. What with the bees of all kinds, the wasps, the various kinds of ticks, gnats, etc., our lives have been made just as miserable as they could well be. We were prepared to encounter the most ferocious cannibals; but the Central African forest, now opened for the first time, contains some horrors within its gloomy bosom that we were not prepared for.

The banks of the river, covered with forest, from the Congo to the Nepoko, are uniformly low; here and there they run to about 40 feet; but, above the Nepoko, hills begin to crop up more frequently, palms are more numerous, and the woods show the tall, white-stemmed trees so characteristic of the slopes of the Lower Congo. *Apropos* of them, the natives have a curious way of clearing the woods: they make a platform, about 10 or 15 or even 20 feet high, and chop the trees down at that height. A clearing will show a few hundreds of trees thus cropped; and, when the bark is decayed, a stranger might fancy, from a first view of the field, that he had come upon a ruined city of temples.

Above the Nepoko, navigation becomes more difficult; rapids are more frequent, and there are two considerable falls to be met with. The land rises steadily until, about 400 miles above Yambuya, the river is contracted into a rushing stream, about 100 yards wide, banked by the steep walls of a cañon; though, of course, in this forest region, woods clothe the slopes and summits—whatever changes the face of the land may show. The forest covers peak, hill, ridge, valley, plain—everywhere it is continuous, nowhere broken except at such clearings as man has made.

We braved this stream, wild as it was, for a few days longer; but finally progress became impossible. We emptied canoes and boats of their loads, mustered the caravan, and found we were so physically weak that we could not carry them. Ulcers, famine, dysentery, had robbed the strength of a great number. The whole of October was spent in gaining the settlement of Kilonga-Longa,[1] about 460 miles above Yambuya (though we had only about 50 miles to travel), sending relief parties back to the survivors of those we had left behind. Had we been a year earlier; say, had we started in 1886 instead of 1887, we should

[1] Kitonga-Longa (?)—Eds.

have met with plenty of food up to the Nyanza; but the Arabs, or two Arabs and their followers, had devastated a whole region. Fungi and wild fruit sustained us, and those who could not get sufficient of the strange things we lived upon, perished, or deserted the starving column to die elsewhere.

You can understand our course hitherto. From Yambuya's position, 1° 17′ N. lat., it reached, with the winding river, 1° 58′ N. lat.; from that point we gradually came south to 1° N. Kilonga-Longa's is in lat. 1° 6′ N., and from this point we struck an almost direct line to Ibwiri, N. lat. 1° 20′—3600 feet above the sea—then direct to Mount Pisgah, whence we first caught a view of the grass-land.

From Kilonga-Longa's to the base of Pisgah the people are Bakumu, and from the south bank of the Ituri to Stanley Falls, on the Congo, the people are known under that term. East of Ituri, above Kilonga-Longa's, the people are Balesse, while in the forest region. The style of villages is a single street, flanked by huts, connected one with another, of uniform height and make. One of their villages is like a long, low hut, say 200, 300, or even 400 yards long, sawn from end to end in half, each half removed from the other to make a street between, varying from 20 feet to 60 feet in width.

Having left the regions invaded by the Arabs and their followers in their search for ivory, we fared well, and lived almost sumptuously. Our people regained their lost strength and became men once more, ready and willing to do anything or go anywhere. We showed them the grass-land; with grass they connected cattle—quite a sufficient inducement to spur them on.

On June 28th we began our march through the forest. On December 5th we entered the grass-land, a beautiful rolling country. On the 6th we crossed a branch of the Ituri, 40 yards broad, flowing from the NNW.; on the 9th we crossed the main Ituri, 125 yards broad, coming from the NNE.; on the 10th we crossed another branch of the Ituri, coming from the ENE.; on the 13th we looked down upon the Albert-Nyanza from a height (by aneroid) of 5,200 feet. This was the highest point of land reached by us, though on either side of this there were points attaining an altitude of quite 6,000 feet, and from this highest point there was a sudden drop of 2,900 feet to the level of the Albert Lake.

As I may say also, that ten minutes' march took us from the head of the stream draining towards the Ituri, to the spot whence we saw the Nyanza at our feet, it does not require much imagination to picture the face or contour of the land from this point, down to the confluence of the Aruwimi, or Ituri, with the Congo. It is like the smooth glacis of a fort, and then a sudden drop to the bottom of the ditch. The sloping glacis would represent the valley of the Ituri up to the crest; and then the deep gulf, 2,900 feet deep, at the bottom of which is the lake.

The Aruwimi has many names,—the Dudu, Biyerre, Suhali, the Nevva,[1] No-Welle, Itiri; but for the last 300 miles of its course, and upward to its source, it has a singular wide-spreading fame under the

[1] Nevoa (?)—Eds.

name of Ituri. The aborigines of the Nyanza, the open plateau and forest tribes down to within a few miles of the Nepoko, all unite in calling it the Ituri. The main Ituri, at the distance of 680 miles from its mouth, is 125 yards wide, and 9 feet deep, and has a current of 3 knots. It appears to run parallel with the Nyanza. Near that group of cones and hills affectionately named Mount Schweinfurth, Mount Junker, and Mount Speke, I would place its highest source. Draw three or four respectable streams draining into it from the crest of the plateau overlooking the Albert Nyanza, and two or three respectable streams flowing into it from the NW.; let the main stream flow SW. to near N. lat. 1°; give it a bow-like form from N. lat. 1° to N. lat. 1°·50′; then let it flow with curves and bends down to N. lat. 1° 17′, near Yambuya,—and you have a sketch of the course of the Aruwimi, or Ituri, from its highest source down to its mouth. The length of this Congo tributary will be 800 miles. We travelled on it and along its banks for 680 miles, on our first march to the Nyanza; for 156 miles along its banks, or near its vicinity, we returned to obtain our boat from Kilonga-Longa's; then we conveyed the boat to the Nyanza for as many miles again; for 408 miles we traversed on its banks or voyaged on its waters to hunt up the rear-column of the expedition. As many miles we must retrace our steps to the Albert Nyanza for the third time. You will therefore agree with me that we have sufficient knowledge of this river for all practical purposes.

On the 25th May 1888, Emin Pasha's Sudanese were drawn in line to salute the advance column as it marched in file towards the Ituri River from the Nyanza. Half-an-hour after we parted.

I was musing, as I walked, on the Pasha and his steamer, when my gun-bearer cried out: "See, sir! what a big mountain! it is covered with salt." I gazed in the direction he pointed out, and there, sure enough,—

> "Some blue peaks in the distance rose,
> And, white against the cold white sky,
> Shone out the crowning snows;"

or rather, to be true, a blue mountain of prodigious height and mass. This then, said I, must be the Ruwenzori, which the natives said had something white like the metal of my lamp on the top. By prismatic compass-bearing, the centre of the summit bore 215° magnetic, from a spot 5 miles from the shore of the Nyanza. I should estimate its distance to be quite 50 miles from where we stood. Whether it is Mount Gordon Bennett or not, I am uncertain. Against the supposition is the fact that I saw no snow on the latter in 1876, that its shape is vastly different, and that Ruwenzori is a little too far west for the position I gave of Gordon Bennett. I doubt whether Gordon Bennett Mountain, if its latitude is correct, is to be seen from a distance of 80 geographical miles in an atmosphere not very remarkable for its clearness. I should say that the snow-line seemed to be about 1000 feet from the summit. There is plenty of room for both Ruwenzori and Gordon Bennett in the intervening space between Beatrice Gulf and the Albert Nyanza.

Apropos of the latter lake, I am utterly at a loss to conjecture how Sir Samuel Baker could stretch it to such an infinite length to the SW.,

from the position of the high land or terrace, or knoll, above Vacovia or Mbakovia. Its extremest southern point is about 1° 11′ N. lat.; I think about four or five miles, at the utmost, from the place where he stood. To make matters more complicated, he says in his book that, the day he viewed it, it was "beautifully clear." If so, he should have seen that he was merely looking at a shallow bay, some ten miles wide and four or five miles long; that into a tongue of the bay enters the Semliki River, a southern tributary of the lake flowing from the SW. through an almost level plain. And if it were a "beautifully clear day," he could not fail to have seen this snowy mountain right before him as he looked towards the SW. "The blue mountains," also, are no other than the slope of the plateau 5200 feet above the sea, or 2900 feet above the Albert. That remarkable cataract also is only the wet face of sheet-rock washed by a small stream about 10 feet wide.

Until we stood in N. lat. 1° 20′ looking down upon the lake, I half suspected that Colonel Mason had committed a grievous error in his observations, or that a large bank of mud, with tall reeds, had prevented him from seeing the lake beyond; but, unfortunately for Sir Samuel's huge lake, Colonel Mason has done his work and mapped the lake so well, that there is nothing left for me but to vouch for the general accuracy of his chart of the Albert Nyanza.

At the south and south-west of the lake there is no mystery. A century (or perhaps more) ago the lake must have been some twelve or fifteen miles longer, and considerably broader opposite Mbakovia than it is now. With the wearing away of the reefs obstructing the Nile below Wadelai, the lake has rapidly receded, and is still doing so, to the astonishment of the Pasha (Emin), who first saw Lake Albert seven or eight years ago. "For," he says, "islands that were near the west shore have now become headlands, occupied by our stations and native villages." Across the lake, from Nyamsassic to Mbakovia, its colour indicates great shallowness, being brown and muddy, like that of a river flowing through alluvial soil. Some of this must, of course, be due to the Semliki River; but, while on board the *Khedive* steamer, from Nyamsassic to N'sabe, I noticed that the pole of the sounding man at the bow constantly touched ground a mile and a half from shore. Near the south end the steamer had to anchor about five miles from shore.

At the south-west end the plain rises from the edge of the lake 1 foot in 180; the plain of the southern end rises at the same rate for about ten miles; a slight change then takes place, as the eastern and western walls of the table-land draw nearer, and *débris* from their slopes, washed by rains and swept by strong winds, humus of grass and thorn forest, have added to its height above the lake. Natives say that, south of this, the plain slopes steeply to the level of the uplands. A shoulder of the western wall prevented us from verifying this, and still beyond must be left until we take our journey homewards.

I look upon this country lying between the Albert Nyanza and the lake discovered by me in 1876 as promising curious revelations. Up to this moment I am not certain to which river the last lake belongs—whether to the Nile or to the Congo. I believe to the latter; but, what

I am sure of is that, it has no connection with the Albert Nyanza. The Ruwenzori slopes must supply a large portion of the water of the Semliki River; the plateau south-west and west must supply the rest. But it is at the water-parting between the Semliki and some other river south, or south-west, that real interest begins.

The tribes inhabiting the forest and valley of the Ituri are undoubted cannibals. Between the Nepoko and the grass-land the dwarfs are exceedingly numerous. They are called Wambutti. The Pasha's people with us recognise in them the Tikki-tikki further north. A few only of these people are to be found south of the Ituri. I suppose we saw about 150 forest villages or camps of the Wambutti. They are a venomous, cowardly, and thievish race, very expert with their arrows, as we found to our cost.

Ugarrowwa, a former tent-boy of Speke's, now grown to be an important man in his region, through wealth unlawfully gathered at the expense of thousands of forest natives, is becoming impatient for this letter. To him I confide it, trusting that it will reach you some time.

HENRY M. STANLEY.

SAMOA.

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(*With a Map.*)

SAMOA is the name of a group of volcanic islands in the centre of the Pacific Ocean. They are situated 2500 miles in a straight line from Sydney, about 4000 miles from San Francisco, and rather more than 400 miles from the British Colony of Fiji. Rose Island, 80 miles east of Samoa, is often erroneously enumerated as one of the group. It is a low uninhabited coral island, which is covered at high water with the exception of two small banks, the larger of which is not more than 30 feet high, and has a few trees growing on it.

The islands of Samoa are twelve in number, but of these only ten are inhabited. They lie between the parallels of 13° 28′ and 14° 22′ south latitude, and the meridians of 169° 30′ and 173° west longitude. It is supposed that they were first discovered by the Dutch expedition under Roggewein in 1722; but the first navigator from whom we have any reliable account of them was Bougainville, who saw them in 1768, and who, struck with the skill which the natives displayed in handling their canoes, named them the "Isles of the Navigators," a name which is often still to be found in the charts, but which has now largely given place to the native name of the group—Samoa. La Pérouse was the next to visit the group. He called there in 1787, and unfortunately came into collision with the natives at Tutuila. A lad who was out at the ship was shot at, and mortally wounded, on account of some real or supposed

stealing. When he was taken on land the islanders were enraged, and made an attack on some of the ship's company who were on shore at the time. In the fight which ensued two officers—MM. de Langle and de Lamanon—and ten of the crew were killed.

This was the first of three engagements which have taken place between Samoans and Europeans. The second was the lamentable skirmish between the natives and the marines and blue-jackets of H.M.S. *Barracouta*, in 1876, when three men were killed and several wounded on the British side, and eight men killed on the Samoan side. The third was the equally lamentable fight of last December, between the Germans and the Samoans, in which of the Germans two officers and sixteen men were killed and thirty-six wounded, and of the Samoans about twelve were killed and thirty-five wounded. Of these three fights, probably the first, and certainly the second, was occasioned by misunderstandings on one or both sides; the third alone seems to have been a deliberately planned engagement. Let us hope it will be the last time that we hear of Europeans and Samoans being engaged in actual warfare.

In 1791 Samoa was visited by H.M.S. *Pandora*, and from this time onward whaling and trading vessels from the United States and from Australia occasionally touched at the group. Little was known, however, about the islands till 1830, when agents of the London Missionary Society landed and commenced a mission there. They were well received by one of the principal chiefs, and in that way Christianity and civilisation were introduced, and speedily made headway among the natives.

The islands of the Samoan group are all volcanic. On approaching them the high mountains are visible on a clear day 50 or 60 miles off, and on drawing nearer these are found to be thickly wooded to their very summits, which are in some instances as much as 3000 or 4000 feet high. In many places the hills descend rapidly to the coast-line, and form a rock-bound precipitous shore. In others the slope is more gradual; a belt of rich alluvial soil covered with luxuriant tropical vegetation intervenes between the hills and the shore, which is protected from the ocean by a barrier-reef. The distance between the reef and the shore varies from a few yards to three or four miles, and the depth of water inside the lagoon, in some places, especially in the vicinity of reef-openings, is fathoms deep, while in others it is only at high water that even small canoes can find their way along. For the most part the Samoan villages are situated along the shore of these lagoons, which greatly facilitate inter-communication. With the exception of these barrier-reefs, there are no outlying coral-reefs in the Samoan group such as those which render navigation so dangerous in Fiji and Tonga. Take these facts together—the position of Samoa right in the track of the mail steamers between America and Australia, the height of the land, the absence of outlying dangers to navigation, and the possession of several good harbours, one of them, Pangopango, being the finest in the Pacific, —and one can readily understand how the control of this little Samoan group has become such a vexed question in European and American politics.

The most easterly of the Samoan group are three small islands, collectively called Manu'a. The largest of these is Ta'u or Manu'a Tele. It rises somewhat precipitously to the height of about 300 feet, and then more gradually to the highest peak, which is 2500 feet. Looked at a few miles off, it has been likened to an immense whale lying on the water. It is about 16 miles in circumference. There is fair anchorage on the north-west side, where the principal village, which is also called Ta'u, is situated. Olosenga, the next island of the group, is a narrow strip of land, three miles long, rising abruptly on both sides. The third and smallest of these islands is Ofu. It lies to the westward of Olosenga. The entire population of these three islands is under 1500.

On 12th September 1866, a submarine volcano broke out in mid-ocean between Ta'u and Olosenga. The following is a condensed account of the occurrence, from an article written at the time by my father, and published in a Sydney newspaper :—"On the 7th September 1866 the natives of Ta'u and Olosenga were surprised by an unusual succession of earthquakes. There would be three or four in the course of an hour. On the night of the 9th there were thirty-nine shocks in all. The motion at first was but a slight tremulous agitation, but its continuance, and the addition of an unusual subterranean 'groaning,' as the natives called it, alarmed every one. On the 12th, a little after noon, a commotion was observed in the deep blue sea, about two miles from Olosenga and three from Ta'u. It appeared like the surf breaking on a sunken rock. Some thought it might be a whale blowing; others that it was a great shoal of fish. This continued all day. By break of day on the 13th volcanic action was unmistakable. At first the eruptions were at intervals of about an hour. They went on increasing till the 15th, when there were fifty in an hour; and then for three days there was one continued succession of outbursts. The natives looked on in amazement at the great jets of mud and dense columns of other volcanic matter rising in terrific grandeur as high, it was said, as the mountain of Matafao in Tutuila. That would be 2000 feet or more. They then branched out into clouds of dust which blackened the sky and covered up Olosenga from the sight of the people on Ta'u. The roar of the eruptions and the collision and crash of the masses of rock met in their downward course by others flying up, was fearful. Quantities of fused obsidian, too, threw off fragments which shone and sparkled in the sunshine with indescribable beauty. No flame appeared. Only once or twice was there a gleam of fire in the matter thrown up. The sea was most violently agitated in a great circular basin half a mile in diameter, and after a time there was a light sulphurous tinge in the ocean for miles away. Heaps of dead fish were washed ashore on Ta'u and Olosenga, and among them deep-sea monsters, six and twelve feet long, which the natives never saw before, and for which they have no name. The sulphurous vapours, heat, smoke, and ashes soon made the settlement in Olosenga unbearable, and the natives fled to a place on the south side of the island. A slight tremulous motion continued to be felt on the land, but no fissures opened, nor did any hot springs make their appearance. The ordinary springs of fresh water were unaffected. After three days the activity of the

volcano began to abate, and two months afterwards there were only three or four eruptions in the course of a day, and the height to which the matter was thrown up was reduced to 30 or 40 feet above the level of the sea."

On November 29th, seventy-eight days after the first outburst, volcanic action ceased. In the following January, 1867, it burst up again like "a great spring of water," accompanied by much shaking on the adjacent islands. This continued at intervals till March 14th, 1867, when the action ceased altogether, and it has remained quiescent ever since.

In June 1867, H.M.S. *Falcon* visited the place, and about two miles distant from Olosenga a distinct cone was made out at a depth of 91 fathoms, the soundings all round about being from 120 fathoms upwards.

The principal point of interest attaching to Manu'a is that, according to one tradition, it was the first part of the group to be inhabited, and from it the Samoan race spread. The hereditary name of the kings of Manu'a is Moa, and according to this tradition the name Samoa is simply this name with the prefix "*Sa*," which in Samoan means "the family of" —Sa-moa, *the family of Moa.*

This derivation of the name, however, is exceedingly doubtful. There are several other traditions all referring to one Lu, the son or grandson of Tagaloa of the heavens—the great God who existed in space—and his fowls, *moa*, which he made *sa* (sacred, not to be killed), hence Sa-moa, *sacred fowls*, or *preserve fowls.*[1]

About 60 miles west of Manu'a lies the island of Tutuila. It is 17 miles long, its greatest width is 5 miles, and it contains an area of about 240 square miles. For the most part the coast of Tutuila is rugged and precipitous, rising suddenly to a height of from 50 to 200 or 300 feet. Above this the island is covered with luxuriant vegetation. The centre of it is mountainous, and the highest peak, Matafao, is 2327 feet above the sea-level. The principal settlements are at Pangopango and Leone. The latter is situated on the south-west side, and at this point there is a considerable stretch of level country, constituting it the most productive district of the island. Pangopango, on the other hand, although much more rugged and less fertile, is of much greater importance, on account of its magnificent harbour. This is situated on the south side of the island, which it deeply penetrates, indeed it nearly divides it in two. In approaching Pangopango Harbour from the sea, it looks a very unlikely place to find any shelter. The shore is rugged and inhospitable everywhere. As you draw nearer, however, a passage nearly three-quarters of a mile in width opens up between Tower Rock and Breaker or Devil's Point. Following this in for about a mile, the inner harbour opens out away to the west, disclosing a beautiful land-locked basin about a mile in length, with a width varying from two-thirds of a mile at the entrance to about 100 yards at the other end, and with a depth of from 6 to 20 fathoms. This basin is surrounded on all sides by hills, which rise abruptly to a height of 800 to 1000 feet, its shores being skirted by coral

[1] *Samoa a Hundred Years ago*, p. 10.

reefs extending from 100 to 200 yards from the beach, which are awash at low water, but immediately outside of which the water is from 4 to 8 fathoms deep. In shape Pangopango has been aptly likened to a retort. The precipitous nature of the hills, causing baffling contrary gusts of wind, constitute the principal danger to vessels which depend on canvas alone, when leaving the harbour. The trade-wind blows almost directly into it, and necessitates their working out against the wind, or waiting, it may be for a week or more, till the wind hauls sufficiently round to enable them to get a favourable slant out. For steamers, however, it is unsurpassed by any harbour in the Pacific—in fact, all the fleets in the world could here ride safely at anchor secure from every wind that blows.

The only danger outside of Pangopango Heads, to be avoided by vessels making the port, is a shoal about 3 miles long and nearly a mile wide the western end of which is about $1\frac{1}{2}$ miles south of Breaker Point. This shoal, however, has never less than $4\frac{1}{2}$ fathoms of water on it, and it is only in very rough weather that the sea breaks over it. Within the heads, and half-way from Breaker Point to the harbour, there is a rock about mid-channel called Whale Rock. It is about 20 feet in diameter, and at low tide has only 8 feet of water over it. It is now marked with a buoy, but doubtless it would be a very simple matter to have it entirely blown out of existence. Another and smaller rock, Grampus Rock, is nearer the shore, and is scarcely necessary to mention. Pangopango is the home of the principal chief of Tutuila, Maunga by name.

A little to the east of the entrance to Pangopango Harbour is the small island of Aunuu, 5 or 6 miles in circumference, which lies half a mile off the coast, is about 500 feet high, and has 500 or 600 inhabitants.

On the north side of Tutuila there are several sheltered coves, where good anchorage may be had during the trade-wind season, and on the shores of which there are settlements. One of these is Massacre Bay, the scene of the disaster met with by La Pérouse, which I have already referred to. The population of Tutuila, inclusive of Aunuu, is nearly 4000.

Thirty-six miles to the westward of Tutuila is Upolu, the principal island of the group, though not the largest. It used to be set down in charts under the names of *Ojalava*, or *Oahtooha*, an example of how easily the first navigators were led astray in the matter of names. *Ojalava* is simply the native words *O io lava*, "it is indeed yonder," doubtless the answer to some question which had been entirely misunderstood, and *Oahtóoha* is the name of the eastern district of the island Atua with the prefix O (*O Atua*).

Upolu is a beautiful, rich, and extremely fertile island, the most populous and the most important politically of the whole group. It is about 40 miles long by 11 miles in its greatest breadth, and it contains an area of 341 square miles. From east to west runs a range of mountains, many of them from 2000 to 3000 feet in height. On the south side of the island the mountain slopes are for the most part abrupt and rugged, except in a few places, such as Falealili, Safata, and Lefangā, where there are extensive tracts of level land with protecting reefs. On the northern side of the island the mountains are further back from the

coast; from them, here and there, smaller ridges or spurs run down to the sea, and between these there are well-watered, fertile valleys, while towards the western end of the island the hills become lower, and gradually trend away into a long, low point. With one or two exceptions the whole of the coast on the north side and at each end is surrounded by a barrier coral reef, with openings here and there leading into harbours, which are convenient and snug during the trade-wind season. There are several good-sized constant streams—they can scarcely be dignified by the name of rivers—along this coast, the largest of which are one at Falefa in Atua, and the Vai Singano, which falls into the sea at Apia, and to which no doubt the harbour of Apia owes its existence. About one-third from the top of the mountain behind Apia there is a beautiful cataract several hundred feet high on one of the sources of the Vai Singano. This can be seen well out to sea by any vessel a little to the west of the port, but vessels coming from the eastward do not open it out till well within the harbour. There are several other smaller cascades to be seen from the sea on other parts of the island.

The scenery of Upolu is very beautiful. One could scarcely imagine a fairer scene than is got when gliding along at high water in a boat or canoe before a steady trade-wind within one of the Upolu lagoons, the ocean surf dashing on the protecting reef to seaward with an ever constant roar, while to landward, just above the line of white coral sand, the coast-line is marked by a continuous row of cocoanut trees, with their feathery heads waving in the breeze. As bay after bay is opened out quiet villages are seen nestling among the trees; and, higher up, the eye wanders over mountain slopes clad to their very summits with dense forest trees, while here and there a gigantic banyan, with its dark green foliage, is to be seen rearing itself head and shoulders above its fellows.

If you land, however, and go into the interior, as soon as you get beyond the settlements most of the beauty vanishes. You find yourself in a dense tropical forest. Trees of many species meet high overhead, forming a leafy canopy through which the sunshine never penetrates. The ground is strewn with dead and decaying leaves, superficial roots of trees cross and intertwine in all directions, and progress on every hand is interrupted by vines and creepers which hang from almost every bough. The air is still and oppressive. As you get nearer the mountain summits the vegetation gets less rank, the trees are more stunted in their growth, but yet everywhere one is walking in a forest, and if the ascent has been gradual the first indication you may get of having reached the top and commenced to go down on the other side is that you begin to notice the streamlets you pass trickling in the opposite direction from those passed before.

Of the mountains many bear traces of being extinct volcanoes. Two of the most remarkable of these deserve a word of mention. Tafua, the most western mountain in the island, is thus described by Humboldt in his *Cosmos*, vol. iv. part i. p. 383: "Most remarkable geologically is the Peak of Tafua in the island of Upolu, belonging to the Samoan group. This peak, 2138 feet high, which was first ascended and measured by Dana, has a large crater quite filled with forest trees and crowned by a

regularly rounded cone of ashes." Writing from memory, I think the descent inside the crater is about one-third of the ascent, the trees growing at the bottom and on the inner slopes are ordinary forest trees, while water and other creepers abound. Round the edge of the cone, which is very distinct, the trees are much more stunted, and when I visited it some of the natives of our party cut down a few of them on the outward slope, and so enabled us to get a glimpse out to sea.

The other crater is one inland from the bay of Faleata, immediately to the west of Apia. Its height is 2570 feet, and within it there is a lake of considerable size and of great depth. There is no outlet to the lake, and the only supply of water to it is from the rainfall. The vegetation round it is very luxuriant, and rare ferns and beautiful orchids are in rich profusion. The native legend as to the origin of the lake is as follows:—"Faleata," the "House of Ata," is a district embracing a number of villages, and was named from a chief Ata. Ata was killed in battle, and his brother Too took it so much to heart, that he went away inland, scooped out a great hollow, and filled it with his tears; and hence the lake there called *Lanutoo*, or "Lake of Too."[1]

Upolu is divided into three states, Atua to the east, Le Tuamasanga in the centre, and Aana to the west, the divisions running right across the island. At the eastern extremity of Upolu are two small islets—Nuutele (large islet), and Nuulua (second islet)—which are unimportant. On Nuutele there are a few inhabitants. The district within the reef enclosing this end of Upolu is called Aleipata, where the titled king of Atua resided. Proceeding down the north side towards the west, the deep bay of Fangaloa is soon reached. It is very little used as an anchorage, as it has the reputation, and rightly so, of being treacherous and unsafe. A little further down the coast, the harbour of Saluafata is situated. It is a small open roadstead, and chiefly remarkable from the fact that exclusive privileges with respect to its use were accorded to Germany by the Treaty between Germany and Samoa of 24th January 1879.

About eight miles below Saluafata is Vailele, one of the largest German plantations on the island. It was in this vicinity that the fight took place between the Samoans and the Germans on the 18th December last.

A little further down the coast is the port of Apia, the capital of Samoa, the residence of the European and American Consuls, and of the principal foreign residents. It is, like Saluafata, an open roadstead, but of much larger size, with good sheltered anchorage during the trade-wind season. In the hurricane season—from December till April—it is a dangerous place, as it is quite open to the north, and thus entirely exposed to these storms, which occasionally blow with great force from that quarter. Vessels caught in this way, are liable to be driven in upon one another, or on shore, or, worse still, on to an inner coral reef which divides the harbour into an eastern and a western portion, and go down in deep water. The disaster of the 16th ultimo, when three German and three

[1] *Samoa a Hundred Years ago*, p. 241.

American war-ships, besides several merchant vessels, were wrecked, is a terrible proof of the reality of this danger.

Apia is a crescent-shaped bay with Matautu Point on the left as you enter, and on the right Mulinuu, a long tongue of land running out and dividing Apia Harbour from the deep bay of Faleata, which is about 6 miles across. From point to point the bay of Apia is about a mile across, but the real harbour is not more than a third of a mile in width. The sand of Apia is black. The Vai Singano River runs into the sea about half a mile from Matautu point, and divides the village of Matautu from that of Apia proper. There is another smaller stream half a mile further round, in the centre of the bay.

Apia possesses a considerable number of good stores—principally British, German, and American, although several other nationalities are also represented; three or four hotels, an English Protestant and a French Catholic church, and schools in connection with both of them. Mulinuu Point has been in recent years the seat of the Samoan Government, and it was there that the skirmish took place in 1876 between the British and the Samoans. Some miles inland from Apia there are some remarkable stone relics. The road to them leads up through one of the prettiest bits of scenery I have seen anywhere—it is the stream bed of one of the feeders of the Vai Singano, and the profusion of mosses and creepers with which rocks and trees on each bank are covered give one the idea that all the fairies in Samoa must here have recently held a competition in decorative art! The relics themselves are a number of stone pillars—the remains of a stone house. These pillars form an ellipse after the model of the best Samoan houses. Many other blocks of stone lie scattered about in the vicinity. It is called by the natives "*Le Fale o le Fe'e*—the house of the Fe'e. The Fe'e or Cuttle-fish were looked upon as war gods, and the legend goes that "a Savaii Fe'e married the daughter of a chief on Upolu, and, for convenience in coming and going, made a hole in the reef, and hence the harbour at Apia. He went up the river also, and built a stone house inland," the relics of which are those just mentioned. In time of war it was said "he sent a branch drifting down the river as a good omen and a sign to the people that they might go on with the war, sure of driving the enemy."[2] If, on the other hand, any attack likely to be disastrous was planned by the enemy, the people were warned of it by mysterious rustling sounds proceeding from the direction of the haunts of this god.

Eight miles west of Apia is Malie, the old capital of the Tuamasanga district, and four miles further on is Malua, the site of the Training College of the London Missionary Society. This college was commenced forty-five years ago. It is carried on by two resident European missionary tutors and one assistant Samoan tutor. The students, who usually number about 100, have to pass an examination before admission, and undergo a four years' course of training. The majority of them are married, and special classes for the students' wives are held. There is also a select class of twenty-five youths from 14 to 18 years of age.

[1] *Samoa a Hundred Years ago*, p. 31.

The college estate contains 300 acres, all under cultivation, bounded by a road three miles in circuit, on either side of which there is a continuous row of cocoanut trees. The estate is worked by the students, and is quite enough to support the entire college community. They have one industrial day during the week, and as the result of the work done on that day there are now 22 stone cottages, 25 other cottages built in Samoan style, a stone class-room, 60 feet by 30, fitted with desks, tables, blackboards, maps, diagrams, and models, and the whole sea frontage of the estate is surrounded with a substantial stone embankment. With the exception of the salaries of the tutors, the entire college is self-supporting.

During the forty-five years that this college has been in existence, there have been trained in it over 900 men, 650 women, and 300 boys. Of these about 200 are now acting as ordained native ministers at the different villages scattered over the Samoan group. They act also as village school teachers, and it is no exaggeration to say that nine-tenths of the education which the Samoan race of the present day possesses, has been imparted to it by these native teachers trained at this institution. Young men from some twenty-seven other islands, outside of the Samoan group, from 200 to 2000 miles away, have been trained here, and after staying their allotted time have returned to help in the education of their countrymen.

A little west of Malua is the boundary of the Tuamasanga district, and four miles further on is Leulumoenga, the capital of the third district of Upolu,—Aana. This district is much flatter and not nearly so well watered as the other two. Between Upolu and Savaii, the remaining large island of the Samoan group, lie the two small islands of Manono and Apolima. The reef at the west end of Upolu extends out to, and includes Manono. This island is three miles in circumference. It is circular in shape, and rises gradually from the sea to a height of about 200 feet in the centre. It is well wooded. Breadfruit trees, cocoanuts, and bananas are in great abundance, and it is famed for the growth of yams. This small island long played a conspicuous part in the political history of the group. This was mainly owing to the possession of the natural fortress of Apolima, which lies between Manono and Savaii.

Apolima is a very remarkable little island. It is evidently the crater of an extinct volcano. Perpendicular cliffs rise abruptly out of the sea, broken down at a single point on the northern side where the waters of the ocean obtain admission, and through which there is only room for one boat at a time to pass to the basin of smooth water within. The inner slopes of this crater are covered with vegetation, and this is the home of about 250 or 300 people.

The distance between Manono and Apolima is not quite a mile. The Manono reefs extend about one-eighth of a mile in the direction of Apolima, and terminate in a small uninhabited islet called Nuulopa. The remainder of the channel is clear for ships of any size. It is safer, however, for vessels to take the other side of Apolima, the distance between it and Savaii being about 7 miles. There is a small rock about 200 yards west of Apolima, and the Savaii reef runs out nearly 3 miles, but between these there is a deep channel from 4 to 5 miles in width.

The population of Upolu, Manono, and Apolima, which are usually taken together, is a little short of 17,000.

Savaii is the largest and most westerly island of the group. It measures about 40 miles from east to west, by 20 from north to south. Its area is 657 square miles and its population 12,500. Commodore Wilkes, in his report of the exploring expedition sent out by the United States Government in 1839 for the purpose of surveying these islands, thus describes this island: "It differs from any of the others in its appearance, for its shore is low, and the ascent thence to the centre is gradual, except where the cones of a few extinct craters are seen. In the middle of the island a peak rises, which is almost continually enveloped in clouds, and is the highest land in the group." Its height is considerably over 4000 feet. "Another marked difference between Savaii and the other large islands is the want of any permanent streams, a circumstance which may be explained, notwithstanding the frequency of rain, by the porous nature of the rock (vesicular lava) of which it is chiefly composed; water, however, gushes out near the shore in copious springs, and when heavy and continued rains have occurred streams are found in the ravines, but these soon disappear after the rains have ceased. The coral reef attached to this island is interrupted to the south and west, where the surf beats full upon the rocky shore. There are in consequence but few places where boats can land, and only one harbour for ships, that of Matautu: even this is unsafe from November to February, when the north-westerly gales prevail. The soil is fertile, and was composed, in every part of the island that was visited, of decomposed volcanic rock and vegetable mould." This description is a very accurate one; the only exception that I feel ought to be taken to it is, that there *is* one good-sized river, perhaps the largest in Samoa, on the south side of the island, falling into the sea at Tufu.

Savaii is frequently politely called in prose and poetry *Sa Lafai*, "sacred to Lafai," who was one of their legendary chiefs. It is divided into three political divisions, Le Faasaleleanga, of which the capital is Safotulafai; Le itu o tane, with its capital Saleaula; and Le itu o fafine, the capital of which is Palauli. The last two names mean respectively *the side of men* and *the side of women*, the former name having been given to the north side on account of their bravery in the war against Aana in 1830.

In the north-west of the island there is a tract of country called *O le mu*, or "the burnt," which is a lava plain of comparatively recent origin. It is divided into two portions, the village of Aopo being between the two, the smaller stream having found its way to the sea to the east of the village, and the larger one to the west of it. Vegetation has only recently commenced over these lava plains, and the estimate made from native accounts that this eruption took place a little over 100 years ago is probably correct.

Falealupo is the settlement at the extreme west of Savaii. It had a fame of its own in olden days. "There were two circular openings among the rocks near the beach at this village, where the souls of the departed were supposed to find an entrance to the world of spirits, away under the ocean, and which they called Pulotu. The chiefs went down

the larger of the two, and the common people had the smaller one. They were conveyed thither by a band of spirits who hovered over the house where they died, and took a straight course in the bush westward. There is a stone at the west end of Upolu, called 'the leaping-stone,' from which spirits in their course leaped into the sea, swam to Manono, leaped from a stone on that island again, crossed to Savaii, and went overland to the *Fafā* at Falealupo, as the entrance to their Hades was called. The villagers in that neighbourhood kept the cocoanut leaf blinds of their houses all closely shut down after dark, so as to keep out the spirits supposed to be constantly passing to and fro."[1]

The climate of Samoa is fairly good. The average temperature at mid-day, taken inside a well-ventilated stone house, is 86°, it never rises above 93°, and it never falls below 80°. At night it is not much cooler. July, August, and September are the coolest months in the year, and February the hottest. During the greater part of the year a fresh trade wind, which veers from south-south-east to north-east, is constantly blowing, and makes the temperature bearable. The most trying season is from November to February, when often there are days together of still, sultry, oppressive weather. Between the months of December and April long-continued and heavy rains are frequent, attended at times with high winds and northerly gales. Occasionally, too, destructive hurricanes occur. They are not so frequent in Samoa, however, as they are a little further south. Hardly a year passes without one of these gales, of more or less severity, passing over some part of the belt between 10° and 20° south latitude. In April 1850 one swept right over the centre of Upolu. Three vessels lying at anchor in Apia harbour were driven on shore, but all on board of them were saved, with one exception—a Rarotongan, who leaped overboard in the night, thinking he might reach the shore. He was never seen again. Another occurred in January 1865, during which a German barque, the *Alster*, lying in Apia harbour, dragged her anchors, struck on the inner reef during the night, and went down immediately. Of her crew of fourteen, one was found in the morning on board a small vessel that was at anchor inside where the *Alster* lay—nearer the shore. He could give no account of himself, nor of the calamity that had befallen the *Alster*, but there he was alive, providentially washed on board. Of all his shipmates not one even of the bodies was ever found. The next cyclone which visited Apia was in March 1879, but the few vessels at anchor in the roadstead at that time successfully rode out the gale. In March 1883 another severe storm occurred, in which several vessels and ten lives were lost. And now we have news of the terrible disaster of 16th ultimo, with its record of the wreck of three German warships, the *Olga*, the *Adler*, and the *Eber*, three American warships, the *Nipsic*, the *Vandalia*, and the *Trenton*, along with eight merchant vessels, and 150 lives—H.M.S. *Calliope* being the only ship in the harbour which escaped, and that owing to the brave daring of her commander, who succeeded in steaming his vessel out in the teeth of the hurricane, and against a tremendous head sea.

[1] *Samoa a Hundred Years ago*, p. 257.

Samoa is subject to frequent shocks of earthquake. There will probably be, on an average, about three or four each year. The shocks are generally double, and consist merely of a tremulous horizontal motion lasting from a few seconds to about one minute. During twelve years residence I only once felt, during an earthquake, anything of a heaving movement. There is neither fact nor tradition of houses being thrown down or lives lost by them.

The *fauna* of Samoa is extremely meagre, while the *flora*, as can well be imagined, is exceedingly rich. The only indigenous quadruped is a small rat, something between a mouse and the Norwegian rat, the latter of which was introduced some years ago. There are four species of land snakes; one is three or four feet long, and another, about a foot long. None are venomous. Forty-eight species of birds exist. Some of them are very beautiful. The most rare is the manumea (*Didunculus Strigirostris*), the nearest living relative of the extinct dodo. Its plumage is a rich chocolate brown on back and wings, with brilliant dark blue and green over its head, neck, and chest. Its size is that of a large pigeon. The lower part of its beak has three deep serrations at each side. It is rapidly becoming extinct, and a full-grown specimen fetches at Apia a price of £5 to £10.

The Punae (*Pareudiastes Pacificus*) is another rare bird. It is said to burrow in the ground. Wild pigeons of a large species (*Carpophaga Pacifica*) abound in the bush, and are much prized as an article of food, their flavour being delicious. One dove, called the Manu-mā (*Ptilonopus Perousei*), is very resplendent. The crown of its head is a bright purple, its back, wings, and tail a pale green, breast white, yellow, and purple intermingled, and the under part of its body is of a very pale grey, with a little tuft of yellow feathers under the tail. There are other doves, two varieties of paroquets, two species of kingfisher, a large bat, and other birds, which I cannot take time to enumerate.

Of fish and shellfish there is great abundance. To the natives, the greatest delicacy they obtain from the sea is the Palolo (*Palolo viridis*), a sea-worm found at certain openings of the reef for only a few hours on the morning after the third quartering of the moon in October and November of each year.

Of timber trees there are many valuable kinds, such as the toa (*Casuarina equisetifolia*), the fetau, a native mahogany (*Calophyllum inophyllum*), and the ifilele (*Afzelia bijuga*), all hard woods. Of shrubs also many useful and ornamental plants exist, such as the lama or candle-nut (*Aleurites Moluccana*), which indeed is more of a tree than a shrub, the u'a or paper-mulberry (*Broussonetia papyrifera*), the ti, from the leaves of which girdles are made (*Cordyline terminalis*), and the tane-tane (*Nothopanax Samoense*), one of the most ornamental of bushes.

In ferns, mosses, creepers, and orchids, Samoa is very rich.

Of fruits there are very many—cocoanut, orange, banana (a great many varieties), pine-apple, custard-apple, papaw-apple, guava, mango, avocado pear, lime, citron, and many more. Some of these are indigenous, others have been introduced. Sugar-cane, cotton, coffee, cinnamon, and nutmeg, all grow exceedingly well—of the last named three or four varieties grow wild.

With regard to vegetables also the Samoans are well off. Talo (*Arum esculentum*) is the finest of these. It grows in the swamps, and does not require much cultivation. The bread-fruit trees bear spontaneously, and furnish food for nearly six months in the year, and yams, sweet potatoes, maize, arrowroot, melons, and pumpkins, are cultivated by the natives for their own use and for sale.

Of plantations owned and cultivated by Europeans and Americans, the largest are those of the Deutsche Handels- und Plantagen-Gesellschaft at Vailele, and Le Mulifanua, in both of which places they have over 2000 acres under cultivation, and that of Messrs. M'Arthur & Company of Auckland at Mangia, the extent of which is about 800 acres.

The Samoans are one of a number of races in the Pacific which are known as Malayo-Polynesians. According to the view now very generally accepted, these races are all offshoots of a family which populated some portion of south-eastern Asia, probably about the Malay Peninsula, and which at some remote period, almost certainly over 3000 years ago, found their way to the Pacific. It would appear from data at our command that Samoa was one of the first groups to be inhabited, and that from this centre the Polynesian race was distributed over the Pacific. The Maoris of New Zealand, for example, trace their origin distinctly to Samoa.

Two descriptions of the Samoans are given in the British Blue Book on Samoan affairs presented to both Houses of Parliament during last month. In a memorandum which was drawn up a few years ago by a gentleman who was in Samoa as British Deputy Commissioner it is said, "they are a fine, tall race, of light brown colour. They are docile, truthful, hospitable, and are lively and vivacious in conversation among themselves, and in their intercourse with foreigners they are exceedingly courteous and polite."

In commenting upon the above another British Commissioner says: "The only exception I take to the accuracy of this description is to the word 'truthful.' The Samoans are an excitable, voluble, credulous people, much given to lying and the circulation of false or extravagant rumours. In some degree they are thieves by instinct, and in many cases are so now by necessity."

The truth is to be found somewhere between these two estimates. I am quite sure that in so far as truthfulness and honesty are concerned the Samoans will compare not unfavourably even with our own countrymen.

They are physically well-formed, have straight hair, regular features, and are very much like Europeans in expression. Mentally they are possessed of much ability, and are capable, under favourable circumstances, of great improvement. They are one of the most polite races on the face of the earth. This is shown in a great many ways, perhaps in none more so than in their language. Special words are used in addressing persons of rank, and in many cases the particular grade of a man's rank is indicated by the word used. For the words *to come*, for example, four different phrases are in constant use—*sau* is used to a common man, *maliu mai* is a respectful form used to those a grade higher, *susu mai* is only used to titled chiefs, and *afio mai* is reserved for those of highest

rank. So with the word *illness*, if a common person is ill his *ma'i* is spoken of, *gasegase* is a more respectful term, while to higher chiefs the words *faatafa* or *pulupulusi* would be used. Every member of a chief's body has a name different from that applied in the case of a common man. His feelings, his actions, and his possessions have different names, and in innumerable instances the common name of a thing is changed for another when that thing is spoken of in his presence. But chiefs in speaking of themselves always use the common language. The language itself, which exhibits many other interesting peculiarities, is a very smooth one, and has been called "the Italian of the Pacific."

In the narrative of Roggewein's voyage of 1722 these natives are thus described: "They were clothed from the waist downwards with fringes and a kind of silken stuff artificially wrought." Had they approached them a little closer, it would have been found that the fringes were their ti-girdles made from the leaves of the ti plant (*Cordyline terminalis*), and the "kind of silken stuff" the tattooing with which all Samoan adult men were covered from the waist down to the knee. This was variegated here and there with stripes and patches of the untattooed skin, each professional tattooer having his own designs, and in the distance it made them appear as though they had on black silk knee-breeches. This custom has in recent years very largely been abandoned.

In time of actual warfare the Samoans are treacherous and cruel: they immediately decapitate any of their enemies who fall into their hands. At other times they are kind and generous to a degree. A good illustration of their character is given in the cablegrams of last week relating the particulars of the wreck of the warships. The German corvette *Olga* was driven on shore, and we are told that subsequently Mataafa, the native chief against whom the Germans had been fighting, "sent a number of his men to the shore, who rendered splendid service in the combined effort made to get her off the beach."

The first correct census made was in 1843, which showed that the entire population of the group numbered 33,900. The last census of which I have been able to obtain notes was taken in 1875, and was as follows:—

Savaii, ...		12,530
Upolu, with Manono and Apolima, . . .		16,568
Tutuila, with Aunuu, ...		3,746
Manu'a, ...		1,421
		34,265
Europeans and Americans, . . .	204	
Natives of other Polynesian Islands, of whom 475 were labourers[1] on plantations, ...	711	
Asiatics, ...	4	
		919
		35,184

[1] The labourers on German plantations alone *now* number about 1000.

From this it will be seen that during the period of 32 years, the population had slightly increased notwithstanding that two long civil wars had been fought, involving the loss of many lives in actual warfare, and many more in consequence of disease and shortness of food, the result of the bush life many of them had to lead during the fighting.

The Samoans are now all nominally Christian. Missionaries of the London Missionary Society, the Wesleyan Missionary Society, and the French Roman Catholic missions, have long been working there, and the census of 1875, already referred to, gave the following to be the number of the adherents of these bodies respectively :—

London Missionary Society, . . .	26,493
Wesleyans, ...	4794
Roman Catholics, ...	2852

There were also a few on Tutuila who professed to be Mormons !

Regarding Samoan commerce, it is a very difficult matter to get at the real facts as to the amount of the exports and imports of the group, partly on account of the rivalry between German and British traders, each trying to magnify his own and depreciate his neighbour's business, and partly from the fact that Apia is the depôt of the German Polynesian Company. German statistics often include imports for the supply of trading stations hundreds of miles away, and German traders frequently represent as Samoan products and evidences of German interests in Samoa, all produce of the South Sea Islands transhipped at Samoa, no matter from where they are brought. The following statistics, taken from the Blue Book already referred to, and compiled by the British Commissioner, are as accurate, probably, as any to be obtained.

The value of the trade of resident British subjects was :—

In 1883,	Imports,	£9,103,	Exports,	£1,180
„ 1884,	„	10,982,	„	2,005
„ 1885,	„	27,733,	„	8,767

" But," it is added, " these figures cannot be said to furnish that degree of information which is so much desired. It appears that the larger part of British trade with natives is for cash, and there are no returns procurable showing the value of remittances by cash and drafts. This circumstance serves to explain the discrepancy between the value of British imports and exports." Of German trade it is said the official returns furnished by the German Consulate at Apia for the year 1885 show £56,324 as imports, and £58,890 as exports. It is added, however : " These figures include imports for the supply of trading stations in 'Samoa and the adjacent islands,' by which is understood all islands south of the equator. In the same manner the exports give the products of both Samoa and the adjacent islands (excluding Tonga, Fiji, and Jaluit). . . . It is, however, declared in Samoa by competent authority, and I believe with truth, that at the outside not more than one-third of the copra exported by the German firms is the produce of Samoa, the other portion being conveyed to Apia for transhipment from widely scattered spots described as 'adjacent islands.'" The trade with America is much smaller than with either Britain or Germany, but it is increasing.

By far the largest quantity of produce exported is copra and cotton. Copra is the kernel of the ripe cocoa-nut sliced and dried in the sun. From it there is expressed, in this country and in Germany, cocoanut oil, and the residue is known as oil-cake, and used for feeding cattle. The imports cover a wide range, in which manufactured goods, iron goods, provisions, tobacco, and timber bulk most largely.

In former days law and order in Samoa were in a fair manner maintained by the union of two things—*civil power* and *superstitious fear*. The latter was an auxiliary to the former, and consisted mainly of an elaborate system of superstitial taboo.

Their government had more of the patriarchal and democratic in it than of the monarchical. In each village there would be a number of titled heads of families, and one of the higher rank called chiefs. The titles of the heads of families are not hereditary. The chiefs, on the other hand, are a most select class, whose pedigree is most carefully traced in their traditional genealogies. One is chosen to bear the title, though there may be others who trace their origin to the same stock, and any of whom may succeed to the title on the death of the one who bears it.

The chief of the village and the heads of families formed the legislative body of the place. These village communities, in numbers of eight or ten, were united for mutual protection into a district, and several districts were joined to form a state. One village was known as the capital of the state, and it was usual to have resident there a higher chief than any of the rest, who bore a title analogous to that of king. Occasionally one chief would have the highest title of two or more of these states, but it has been very rarely in the history of Samoa that all the highest titles were borne by a single chief.

The first Samoan hero who is pre-eminent in tradition, was a chief of Savaii, Manono, and the Tuamasanga called Savea. Samoa had been invaded by the Tongans, who had obtained the mastery over them. Several versions of the story are given, but all agree that Savea led the Samoans against the Tongans, routed them and drove them from the islands, and in recognition of his bravery, the title of Malietoa, *Pleasing Hero*, was originated. From Savea, the first Malietoa, there follow twenty generations of Malietoa down to Malietoa Fitu Semani, the chief who received the missionaries Williams and Barff in 1830. He had *all* the Royal titles of Samoa. He was succeeded by his son Tavita, who also had all the titles. About 1866 Malietoa Molī, a brother and successor of Tavita, died, and there were two candidates for the vacant title, Laupepa, son of Molī, and Talavou, an uncle of Laupepa. War broke out in 1868 between the partisans of these two chiefs, and went on for five years.

It was during this war that land began to be sold recklessly by the natives. It is true that a good deal of land had been sold by them previously, but only in small quantities, at a fair price, and in a regular way. About this time a representative of an American company called the Polynesian Land and Commercial Company, arrived in Samoa, and offered to buy land from any one who would sell. A mania for selling land set in. The natives were anxious to get superior arms and ammunition

for the war, and when they found that all they had to do, in order to get what they wanted, was to say they had a piece of land to sell, give its name and its approximate dimensions, and sign their name, they flocked in hundreds to the buyers. In innumerable instances large tracts of land were sold by persons who had no right to dispose of them, and in many cases the price given was at least as low as one shilling and sixpence per acre.

The Germans and others followed the lead of the American Company in buying up all the lands they could, and I have heard of instances where a piece of land was sold two or three times on the same day to different buyers. There was no public notification of the lands bought, and no attempts to prevent overlapping. Next to the American Company, the largest purchasers of land were the firm of Messrs. J. C. Goddefroy & Son of Hamburgh, who about the year 1857 had established themselves in Samoa, and at the time now referred to had a large business in the group.

In 1873 the Samoans, in deference to the entreaties of the Consuls and Missionaries, agreed to give up hostilities. With a view to prevent the recurrence of these civil strifes, a proposal was made and accepted, that all parties should unite in setting up a government for the whole group. A constitution was adopted consisting of a House of Representatives and a House of Nobles, and in order to unite and please all parties and give a better chance of a stable government, it was resolved to choose, as joint kings, one of the Malietoas, and a chief of another ancient Samoan royal stock, that of Tupua. Chiefs of this Tupua stock had been ruling kings of the state of Atua even before the time of the first Malietoa, and it was with the view of conciliating that important state, and their political ally the state of Aana, and preventing the recurrence of the ancient feud between Atua and Aana on the one side, and the Malietoa states of Le Tuamasanga, Manono, and Savaii on the other, that this proposal of joint kings was adopted. A chief called Pulepule of the Tupua family was elected as the one king, and Malietoa Laupepa the other, the uncle of the latter, Talavou, retiring in dudgeon to Savaii. This government had just been formed when complications from a new and unexpected quarter arose. Presumably in consequence of representations made by the Land and Commercial Company to the United States Government, Colonel Steinberger was sent out to Samoa "in the capacity of special agent, to make observation and report upon the character and condition of their inhabitants."[1] This gentleman, who arrived at the islands in a ship-of-war, represented himself as having been sent out by the American Government to pave the way for the establishment of a protectorate by that country over Samoa. The natives, who had, on more than one occasion previously, petitioned for a British protectorate, hailed the idea with delight. They felt the task of governing themselves, without assistance, was beyond them; they feared the ever-increasing German influence, and they said, "if we cannot get the mother (Britain) to help us, let us get the daughter

[1] Extract from a letter received by S. S. Foster, Esq., Consul of the United States, Samoa, from the United States Government.

(United States)." Steinberger went back to America with his report, and some months afterwards (early in 1875) returned to Samoa, the bearer of a number of presents from the United States Government to the natives. On this occasion his instructions were, "your functions will be limited to observing and reporting upon Samoan affairs, and to impressing those in authority there with the lively interest which we take in their happiness and welfare." Two months before these instructions were written, Steinberger had, as was afterwards discovered, entered into a mercantile agreement with the Messrs. Goddefroy, in Hamburgh, "to establish a government in Samoa, and to identify the interests of the Samoan Government with that of the establishment of this firm at Apia." I quote from an article on Samoa, by Mr. C. Kinloch Cooke, in *The Nineteenth Century* for February 1886, in which the full text of this agreement is given. With the opposition of the Germans thus disarmed, Steinberger carried everything before him. He persuaded the natives to alter their constitution. Satisfying himself that Malietoa was the chief having the greatest influence in the group, he got them to choose one king to rule for a period of seven years. Malietoa Laupepa was chosen, and Steinberger was, by acclamation, elected his premier. Probably he thought that before seven years had expired his power would be so established that he would be able to do without a king! But, if so, he reckoned without his host! Suspicious rumours as to his true character became rife. He was called upon to produce his credentials, but was unable to do so. King Malietoa rose to the occasion. He appealed to the United States consul to arrest and deport Steinberger, and this was done. At this, his supporters were furious. In their first outburst of rage they drove Malietoa from the throne, and again civil war broke out. It was at this juncture, while trying to mediate with the Steinberger party in favour of Malietoa, that the captain of H.M.S. *Barracouta* came into collision with the natives as previously referred to. The war continued till 1879, when the party of Malietoa, having again got the best of the fighting, Captain Deinhardt, of H.I.G.M.S. *Bismarck*, acting on behalf of the representatives of the United States and Great Britain as well as Germany, interfered in the strife, and the war was brought to a close. Malietoa Talavou was declared to be king for life, with Malietoa Laupepa—who had given up the highest position to his uncle in order to heal the family feuds—as Regent. This Government was recognised by the three Powers just mentioned.

Meantime, and while the civil war was being fought, treaties had been entered into between the *de facto* Governments of Samoa with the United States on 17th January 1878, with Germany on 24th January 1879, and with Great Britain on 27th August 1879.

In the first of these three treaties, the United States had confirmed to them the right to use Pangopango harbour as a naval and coaling station, which right had already been conceded to them in 1870 by an agreement made between Maunga of Tutuila and Captain Meade of the U.S.S. *Narragansett*.

In the second of these treaties, the Germans obtained the exclusive use of Saluafata harbour, and in the third the following Article occurs:—

"ART. VIII.—*Her Majesty the Queen of Great Britain may, if she think fit, establish on the shores of a Samoan harbour, to be hereafter designated by Her Majesty, a naval station and coaling depôt; but this Article shall not apply to the harbours of Apia or Saluafata, or to that part of the harbour of Pangopango which may be hereafter selected by the Government of the United States as a station, etc.*" Each of the three treaties also contain a *most favoured nation* clause. In the end of 1880 Malietoa Talavou died, and was succeeded, early in 1881, by Malietoa Laupepa.

The partisans of the Tupua family again gave some trouble. Pulepule was dead, but they brought forward as their candidate a chief called Tamasese. He was not recognised, however, by the Consuls, who gave their support to Malietoa, and in July 1881 both native parties made up matters. Malietoa Laupepa was accepted as King, and recognised as such by the Treaty Powers, and Tamasese was appointed as Vice-King.

Still things did not go on smoothly. The native Government consisted of too many discordant elements to permit of its succeeding without foreign assistance, and foreign intervention was too often employed in a way which simply made matters worse. It is impossible to give even a *résumé* of the more important events of the next few years. One reads of the King and Vice-King signing another treaty with Germany, and a few weeks afterwards sending a piteous protest to the German Emperor, saying that they had only signed the treaty "on account of fear, and through being constantly threatened"; of this treaty being disallowed by England and America; of another petition to Britain for annexation which could not be accepted; and of Tamasese breaking off from Malietoa, and setting up an opposition government at Leulumoenga, and of his being supported in his action by the Germans.

Meantime negotiations had been proceeding between the Treaty Powers with a view to some satisfactory settlement of the question. A delimitation treaty, by which it was formally agreed that Samoa and some other groups should be declared absolutely neutral territory, was in 1886 signed by Germany and Great Britain. Commissioners of the Treaty Powers were sent to Samoa to personally gather all information on the subject, and a conference of representatives of these Powers met in Washington early in 1887. No conclusion could be arrived at. A German squadron of four ships reached Samoa on 20th August 1887, and three days later a demand was made on Malietoa for $13,000 (£2600), $1000 being a fine for certain Germans who had been wounded in a brawl with Samoans a short time previously, and $12,000 for alleged depredations committed during the previous four years on the property of Germans. A reply was required in twenty-four hours. Malietoa begged for a few days' time. This was refused, and next day war was declared against him. He fled to the bush, and the Germans brought Tamasese up to Apia and proclaimed him king. At the end of three weeks' time Malietoa voluntarily gave himself up to the Germans, and was deported from Samoa. In the proclamation which he issued when yielding himself into captivity, he says that he does so "on account of my great love for my country and my great affection to all Samoa. . . . I do not desire that the blood of Samoa shall be again

spilt for me." Malietoa was taken first to the Cameroons, but now it is understood that he is on one of the Marshall Islands.

There was quietness for a short time in Samoa after this; but ere long the Malietoa party again rose and made war on Tamasese. On this occasion they were headed by a chief called Mataafa, who is connected with the Malietoa family by birth, and with the Tupua family by adoption. At first the Germans allowed the natives to fight the matter out among themselves; but on the 17th December last, it is said the German ship of war *Eber* shelled the headquarters of Mataafa on account of some trespassing on German plantations; and next day a German force of about 150 landed with the intention of disarming Mataafa's men, and the issue was the fight of that day with its sad results, and all the complications which have since ensued.

Another conference is to be held in a few weeks in Berlin, and while we await its assembling, it is only natural to ask why the Washington Conference was nugatory as to results.

It would seem that the position taken by the Germans was that the only solution of the difficulty could be in the assumption of the Government of the islands by one of the Powers in the name and on behalf of the Samoan king; and that the Power assuming such control should be Germany, on account of her preponderating interests in the group. The British Government, it would seem, was not indisposed to allow Germany some such mandatory powers, admitting her preponderating interests. The position of the United States, on the other hand, is best given in their Commissioner's own words, "If it were true that German interests did predominate, it would be, to my mind, an additional reason why Germany should not be allowed to control the Government, and there are reasons why the British Government should not be selected for the sole control of these islands. As is the case with Germany, so Great Britain is pursuing a policy of the annexation and acquisition of the South Pacific Islands, which renders it incumbent upon the United States, if they desire absolutely to secure the future autonomy and neutrality of this group, to object to the assumption by either of these powers of the absolute control of the Samoan Government, even under the most guarded treaty. The only solution of this difficulty that I can see is, that the other powers shall consent to the selection of the United States, as a single power, to exercise the necessary oversight in connection with the new government to be formed. The freedom of our country from any disposition to absorb territory in that region was fully recognised by the representatives both of Great Britain and Germany. The fact that our concern in the matter does not arise from the preponderance of the interests of our citizens, but solely from a desire, arising from a national policy, to preserve the independence and neutrality of this group, is a reason why there should be a greater degree of confidence in the disinterested action of our Government, and the conservation of the interests of the native population, to whom the country really belongs, as well as those of foreigners who have located themselves and their business interests there."[1]

[1] *Samoa*, No. 1, 1889.

This argument is not a little amusing. And yet, is there not a great deal of reason in it? I think the *Samoans* would think so!

It is argued that German interests predominate. Let us look for a moment at this question.

		Acres.
The total area of land in Samoa is estimated at :—		670,720
Of this is claimed by Germans, . .	135,122	
„ „ British, . .	283,600	
„ „ Anglo-Americans, .	276,000	
		694,722
We have here a deficit of . .		24,002

This shows that until some investigation of the question of land purchases is held, it is impossible to say which nationality owns the most.

But it is argued that the Germans have sunk much capital in improving their lands, while a very small proportion of British and American owned lands have been cultivated. This is true, and yet it ought to be remembered "that British interests have been retarded by the disability of British subjects to procure Polynesian labourers, and to sell alcoholic liquors, arms, and ammunition to natives."[1]

But is "the Almighty Dollar" to be the only factor in the case? Are the wishes of the Samoans themselves to count for nothing? Is it to count for nothing that they have over and over again applied to Britain for protection, and that they would hail with delight a British or an American Protectorate, while they would view with very different feelings the establishment of German rule in their midst? And is it to count for nothing that almost all the education and culture the Samoans possess have been derived by them from British missionaries?

To my mind, the following would seem to be the most satisfactory solution of this vexed question :—

1. Let an international Land Commission be appointed, consisting of one representative of each of the three Treaty Powers and one Samoan. Let there be a thoroughly impartial investigation into all past land purchases, and into all cases of a *recently introduced system of getting the natives to mortgage their communal* (*village*) *lands and their crops*. This would be a gigantic and expensive work, and yet it is the first step necessary to put matters right. It must be evident to every one that the land question is the most fruitful source of the constantly recurring troubles between the Samoans and Foreign Powers. And surely the expense necessary for such a commission ought not to be mentioned in comparison with the loss of life and money, which is the result of the present system of simply allowing matters to drift.

2. Inasmuch as certain conditions contained in the different Treaties between Samoa and the Treaty Powers are such as to make it impossible for any adequate revenue for the purposes of administration to be raised, and for any local Government to be formed which would deserve recognition, the Treaty Powers should agree to give up such of the provisions

[1] *Samoa*, No. 1, 1889.

of the respective treaties as bar the imposition of taxes or duties, without which the expenses of no Government, however simple, can be met.

3. The Samoans should be invited again to choose their own king, Malietoa Laupepa being returned by Germany to Samoa from his exile, and being declared eligible for election. Malietoa Laupepa is fifty-five years of age. He was, when a youth, seven years under training at the Malua College, and is one of the most intelligent and reliable of Samoan chiefs. Tamasese is sixty-five years of age. He is more a Samoan of the old school, not having had the early advantages which Laupepa had. Mataafa is sixty years old.

4. The Treaty Powers should, *on a footing of absolute equality*, agree to assist the natives in governing Samoa, by each sending out one representative, who should be independent of the Consul representing his nation; and these representatives should, with the Samoan king, form the executive of the new Samoan Government. This would, of course, necessitate the drawing out of a new constitution, and its adoption by the natives.

5. The Samoans should be induced to disarm, and all importation of arms and ammunition should be rigidly prohibited.

Let us hope that, for the sake of our common humanity, the three Powers will be able, at their coming conference, on some such basis as I have here sketched, to come to an agreement which will be honourable to all concerned, and which will cause happiness and prosperity to once more dawn on Samoa.

THE PORTUGUESE IN NYASSALAND.

By J. Batalha-Reis,

Member of the Geographical Society of Lisbon, etc.

English historians, geographers, and travellers have, for many years, made assertions regarding Africa which lead to the supposition that they either do not know, or do not present in their true light, many of the documents which refer to the discovery and exploration of that continent by the nations of Europe. Newspapers, literary magazines, books of history, and even geographical papers, repeat incorrect statements, uncontradicted, almost daily, so that, when, at length, the attention of politicians is called to African matters, they find themselves faced by a history and a geography, in many respects imaginary and false, but standing as though incontrovertible.

I now present some of these ignored or forgotten documents, and, following precisely the example of other writers in the *Scottish Geographical Magazine*, I will, in brief terms, call attention to the importance of those documents in regard to the actual situation in that part of Africa to which they refer.

I. It seems to be a settled opinion in England and Scotland that their travellers discovered, visited, explored, what they all style "Nyassa-

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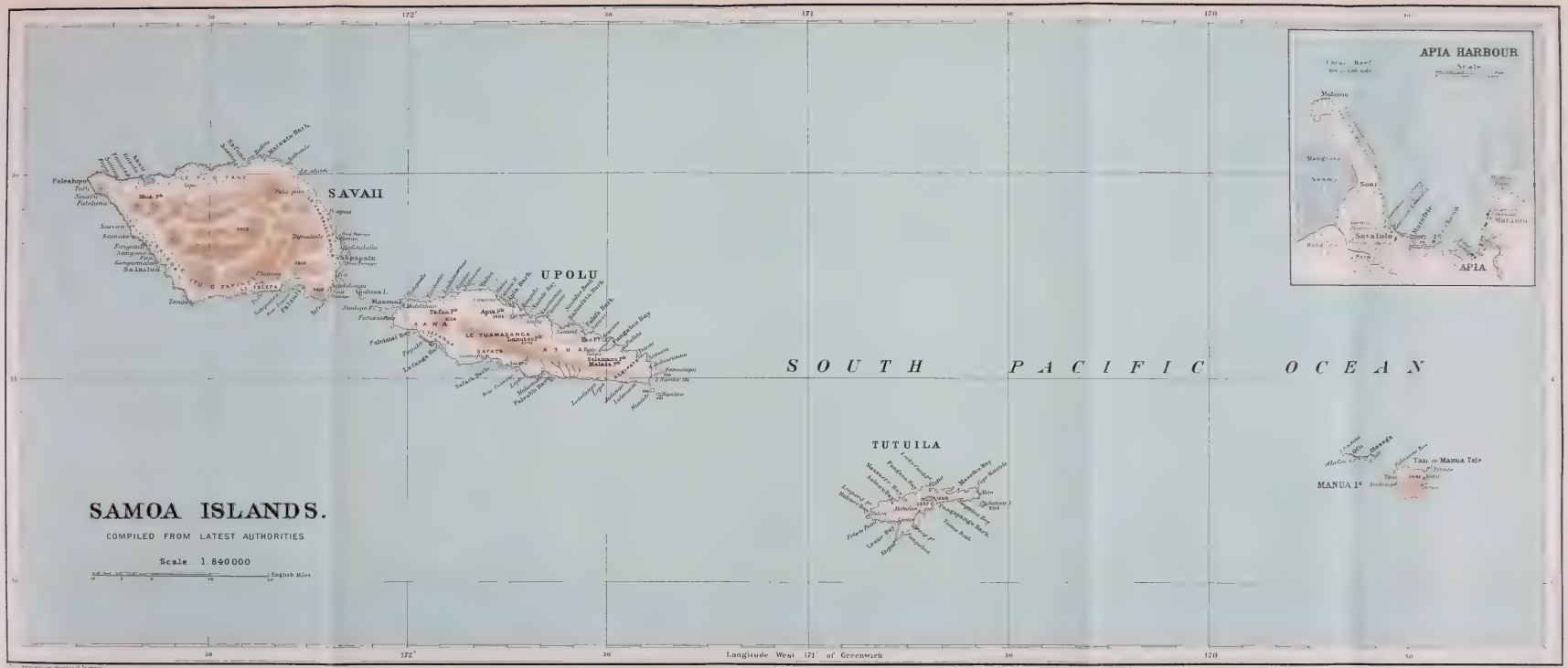
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COMPILED FROM LATEST AUTHORITIES
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SOUTH PACIFIC OCEAN
Longitude West 171° of Greenwich
172°
171°
170°

land" before the Portuguese did, and that therefore Great Britain has a superior right over Portugal to political sway in these territories. This is the point which I propose to examine historically.

Let us first, however, see what "Nyassaland" may embrace. The territories included under this denomination are naturally divided into the four following regions :—

1st. Lake Nyassa and its margins.

2d. The districts bordering on the Shiré, between Lake Nyassa and the Zambesi.

3d. The districts from Lake Nyassa to the shores of the Indian Ocean.

4th. The districts from Lake Nyassa, west.

II. We will first endeavour to ascertain, by investigating some documents, who first knew and visited the Nyassa.

In a letter written from Tete, on the margins of the Zambesi, by the Portuguese Luiz Mariano, in 1624, one reads the following :—

"Lake Hemosura is 27 days' march from Tete. It is half a league from Maravi. From this lake flows the river Cherim,[1] at first peacefully, but which, afterwards, on account of the numerous rocks that it meets, and where its waters are broken, becomes so impetuous as to be unnavigable. Maravi is situated between the lake and the Zambesi. It is a densely populated place, and we [the Portuguese] carry on much trade with its inhabitants . . . have no knowledge of the extremity of the lake, it being so long. It is four or five leagues wide, and, in some parts, land cannot be seen from one side to the other."

This letter, the original of which was still, in the eighteenth century, found in the archives of the Goa Jesuits, as Father Francisco de Sousa informs us,[2] was published in Rome in 1627.[3]

Hemosura is the name which belonged also to a chief who was found established near Lake Nyassa, and with whom the Portuguese had relations in the commencement of the eighteenth century.

In the river *Cherim*, with the *rocks obstructing its course*, it is not, I judge, difficult to recognise the *Shiré* with the *falls*, known to Englishmen by the name of "*Murchison's*."

In 1665, the Portuguese traveller Manoel Godinho published the following description :—

". . . Lake Zachaf . . . is 15 leagues wide, but its length has not, so far, been ascertained. . . . According to a map which I have seen, made by a Portuguese, who passed many years in Monomotapa . . . and other kingdoms of that Kaffraria, this lake is not very far from the Zimbooe or Court of Marabia ; . . . thence there issues . . . the river Chire, which . . . flows into the Cuama[4] [Zambesi] below Sena. . . . He who would desire to follow this route [to pass from Angola to the Indian Ocean] should make for the said Lake Zachaf, and, finding it,

[1] When I cite ancient authors I retain, in the African names, the orthography of these authors. *Ch* in Portuguese is pronounced like *sh* in English.

[2] *Oriente Conquistado*, vol. i. p. 839. Lisbon, 1710.

[3] *Lettere annue d'Ethiopia, etc., d' all' anno* 1620-1624, p. 334.

[4] Kwama.

descend by these rivers to our forts of Tete and Sena, and thence to the bar of Quilimane. . . . That this lake exists I am informed by Portuguese who reached it, travelling by the river named." [1]

And in 1710 Francisco de Souza, in a book written in 1695, from narratives and documents largely of the sixteenth century, published the following :—

"All the other lands stretching to the confines of the Maravi country, which extends to the town of Tete, belong to kings and rulers who rendered vassalage to the Portuguese . . . The town of Maravi, whence the principal kingdom took its name . . . is a little more than 60 leagues from Tete, being in the *sertão* [wilds] to the NNE., and may be in lat. 12°, a little more or less. Half a league from this town a lake is seen which extends, partly NE. partly N., and no one, as yet, knows whither. Its width is from 4 to 5 leagues and more, and the eastern shore cannot in some parts be seen . . . It is strewn with uninhabited islands. . . . It abounds in fish, and, with the force of the wind, becomes very wild, great waves being formed. . . . The kingdom of Maravi lies between this lake and the Zambesi. . . . Cosmographers should, however, be advised, if they wish to trace this lake on their maps, that it does not commence in contact with Maravi town, but a good distance further south." And, wishing to change the subject, Francisco de Sousa continues : "Let us now turn from the *ennui*, which is caused by our being occupied with these lands more known and visited by the Portuguese," etc. . . .[2]

But how far did the Portuguese know the river Shiré and Lake Nyassa, so as to estimate their importance in regard to the interior districts of Africa ?

By what has been transcribed from Manuel Godinho, it is manifest that he, in 1665, indicated Lake Nyassa and the river Shiré, as forming part of the best route to follow in traversing Africa from the Atlantic to the Indian Ocean.

But, further, this is what Francisco de Sousa says, in 1695 :—"The priests of the Society [of Jesus] were formerly desirous to avail themselves of the navigation by this lake [of the Maravi] in going as far as Ethiopia, the ports of which, on the Red Sea, were, at that time, under Turkish rule. . . . This work of discovery requires royal power, and on the banks of the said lake sailing and rowing vessels should be built . . . as it is impossible that in small *cochos* [boats] men can stand so prolonged and uncertain a voyage. . . . Further on running by the . . . margin [of the lake] fifteen days' journey, the kingdom of Massi [Masasi, Masari, Muassi, or Muazi], and travelling on as many more days, more or less, the kingdom of the Ruengas, almost in the latitude of Mombaça" [Ruga, Ruaha, U-rungu, U-rundi ?] [3]

This is how the Portuguese, early in the seventeenth century, were aware of the importance of the Shiré and of Lake Nyassa as a route to the centre and north of Africa. I have been very careful to cite, not only the

[1] *Relação da nova conquista que fez por terra e mar vindo da India para Portugal no anno de* 1663, Lisboa, 1665 ; Ed. 1842, p. 200.

[2] *Oriente Conquistado*, vol. i. pp. 838, 839.

[3] *Ibid.* pp. 838, 839 ; ed. 1710.

text of the documents, but also the titles of the works in which they are found, with the year, the volume, and the pages of the edition which I have made use of. From what has been translated, it may principally be concluded that, from the sixteenth to the seventeenth century :—

First.—The Portuguese knew a lake, to the north of Tete and Sena, stretching away to the south and to the north of 12° S. lat.

Second.—This lake was so extensive that its northern boundary was unknown.

Third.—The width of the lake, estimated by some at four or five leagues, and by others at fifteen leagues, is such that, at certain points, one shore cannot be seen from the other.

Fourth.—From the southern extremity of this lake a river, called *Cherim* or *Chire* (Shiré), flows, which empties itself into the *Cuama* (Zambesi) below Sena.

Fifth.—The river has great rocks at a point in its course which render navigation there impossible.

Sixth.—By the river, the Portuguese ascended to the great lake before the middle of the seventeenth century.

Seventh.—Of this lake and river there was, at the same period, a map made by the Portuguese.

Eighth.—From the sixteenth century the lands from Tete to the Maravi belonged to chiefs who were vassals of Portugal.

Ninth.—In the beginning of the seventeenth century the Portuguese carried on much trade with the Maravi.

Tenth.—These lands were well known to and visited by the Portuguese.

Eleventh.—The river named Shiré, and the lake styled "of the Maravi" were recognised, and pointed out, by the Portuguese of the seventeenth century, as the best route to the centre of Africa.

It is long after this that Livingstone, having visited the Shiré in January 1859, and Lake Nyassa in September of the same year, writes :—"As we descended [the Lower Shiré], we passed a deep stream, about thirty yards wide, flowing from a body of open water . . . The lagoon itself is called Nyanja Pangon (Little Lake), while the elephant marsh goes by the name of Nyanja Mukulu (Great Lake). . . . No one would believe that beyond these Little and Great Nyanjas, Portuguese geographical knowledge never extended . . . the Shiré cataracts are ignored . . . a vague rumour, cited by some old author, about two marshes below Murchison's Cataracts, is considered conclusive evidence,"[1] etc.

Thus the minute descriptions of several authors, which I have just presented, are, in the opinion of Livingstone, "*a vague rumour cited by some old author*"! The lake, extending to the south and to the north of the twelfth parallel, by which it was proposed to reach the centre of Africa, Abyssinia, and Angola, were, for Livingstone, "*two marshes below Murchison's cataracts*"![2] These cataracts of the Shiré, described as far back as 1624 by Luiz Mariano, were, according to Livingstone, "ignored"

[1] David and Charles Livingstone, *Narrative of an Expedition to the Zambesi*, 1858-1864, pp. 90, 91, and 111.

[2] All the italics are mine.

by the Portuguese! It seems to me needless to insist upon the comparison of the passages from the Portuguese authors with those from Livingstone, which I have carefully indicated. Livingstone well says: "No one would believe" that the Portuguese judged the marshes of the Shiré to be Lake Nyassa. It is a pity that Livingstone himself should have believed it. No one admires David Livingstone more than I do; but all the deep admiration in which I hold the great Scotch explorer is not sufficient to make me deny, or fail to understand, what was written more than two centuries before Livingstone, and which has from that time been known.

Sir Richard Burton, the great English traveller and philologist, wrote thus:—"With the greatest admiration of Dr. Livingstone's thoroughness, I am compelled to own that he has done scanty justice to that little but heroic nation which pierced for Europe a new pathway to the East. In fact, the very mention of Portuguese explorations seems to act upon him as a red rag."[1]

And the Rev. Brucker, a learned French geographer, treating of the very subject which gives occasion for my paper, says:—"The Shiré was known to, and was navigated by, the Portuguese in the seventeenth century, notwithstanding all that Livingstone said, . . . who often denied what he was ignorant of."[2]

I would ask the impartial readers of *The Scottish Geographical Magazine*, who have not been aware of the descriptions of Lake Nyassa and the Shiré, which I have translated from the Portuguese, if, after reading them, they can accept Livingstone's words, or those of Professor H. Drummond, who says that Lake Nyassa was "*quite unknown*" (the italics are mine) before Livingstone discovered it,[3] or those of the Rev. H. Waller, who said that Lieutenant Cardoso (1886) was "the first Portuguese . . . that ever reached Lake Nyassa,"[4] or those of Mr. Silva White, who wrote that "Livingstone's expedition discovered (1859) the Shiré route and Lake Nyassa,"[5] not to quote more English and Scotch geographers who, up to to-day, perhaps with excellent patriotic sentiments, but in serious antagonism against truth, have taught the inhabitants of Great Britain a history and geography which I have already taken the liberty of styling *imaginary*.

It is thus, I judge, proved, in regard to Lake Nyassa and the river Shiré, that priority of discovery and priority of acquaintance with these waterways, as well as of their importance in Africa, belong to the Portuguese.

III. Let us now see who first discovered and frequented the other districts which, surrounding the great lake, may be called "Nyassaland."

We have already noted how the Shiré and its margins were frequented by the Portuguese from the sixteenth century. But in the present

[1] *Supplementary Papers to the M'Wata Cazembe*, p. x., 1873.
[2] *Découverte des grands lacs de l'Afrique centrale*, 1878, p. 18.
[3] *Tropical Africa*, 1888, p. 8.
[4] *On some African Entanglements*, p. 8.
[5] *Scottish Geographical Magazine*, vol. iv. p. 301. 1888.

century, many Portuguese knew of the existence of Lake Nyassa, and of its relation to the Shiré, long before Livingstone did, they having gone thither by following the river's course, more or less, and by travelling from the Zambesi to the territories which border on the lake.

Ignacio de Menezes, father of a man very well known on the Zambesi to-day by the name of Ignacinho, had done so.[1]

In 1824, João de Jesus Maria, of the Marral *Prazo*,[2] accompanied by Caetano Xavier Velasques, son of Pedro Xavier Valesques, who accompanied Dr. Lacerda to the Cazembe in 1798,[3] travelled from Quilimane to the Shiré, and thence to the Nyassa, even annexing, in the name of the Portuguese Government, some of the territories to the east of the river, and between it and Lake Shirwa.[4] This journey was repeated for trade purposes up to 1846.[5] In 1858 João de Jesus Maria was ill at the time that Livingstone's expedition entered the Zambesi. Dr. Kirk was called in to attend him, and heard, from his own mouth, very minute information regarding Lake Nyassa.[6]

Romão de Jesus Maria, son of the aforesaid, and an explorer also of Marral, has, since his father's death, kept up, more or less, the relations which by his travels he had opened up.[7]

In 1853, J. B. Abreu da Silva, and his brother Victoriano Romão J. da Silva, proprietors in Quilimane, went on a trading expedition in search of ivory across the M'Nguro mountain ranges, between the Shiré and Quilimane, to Maganja, west of the Shiré and west and south-west of the Nyassa, to the valley of Aroangoa, and as far as the vicinity of Lake Bemba. Robbed by the natives, they, in defence, fought them, and, authorised by the government of Quilimane, subjugated many chiefs. And again, prior to Livingstone, the Shiré and its territories were visited by J. A. Correia Pereira of Mahindo *Prazo*, and Miguel N. da Silva.[8]

From 1846, Candido de Costa Cardoso, a resident at Tete, traded with the margins of the Shiré and Lake Nyassa districts. In March 1856, Cardoso described Lake Nyassa and the river Shiré to Livingstone.

We have already seen, further back, what Livingstone wrote in 1865 regarding the ignorance which, as he judged, the Portuguese were in regarding Lake Nyassa. Here, however, we now have what he wrote whilst at Tete in 1856 :—

"Senhor Candido had visited a lake 45 days to the NNW. of Tete, which is probably the Lake Maravi of geographers, as in going thither they pass through the people of that name. The inhabitants of its southern coast are named Shira; those on the north, Mujos; and they call the lake Nyanja or Nyanje . . . He stated that he crossed the Nyanje at a narrow part, and was 36 hours in the passage . . . it may be 60 or

[1] J. J. Machado, *Moçambique*, p. 29.

[2] A *Prazo* in Mozambique is a portion of territory conceded by the State, a Crown grant.

[3] Captain Burton, *The Lands of Cazembe*, p. 8 and *passim*.

[4] J. J. Machado, *Moçambique*, p. 29.

[5] J. J. Correia Pereira, *Notas ao Ministerio do Ultramar. Economista*, Lisbon, Sept. 1888.

[6] J. J. Machado, *Moçambique*, p. 29.

[7] Affonso de Moraes Sarmento, *Communicaõçes ao Ministerio do Ultramar*, 1888.

[8] J. A. Correia Pereira, *Notas ao Ministerio do Ultramar. Economista*, Sept. 1888.

70 miles in breadth. . . . From the southern extremity of the lake, two rivers issue forth . . . the Shiré, which flows into the Zambesi, a little below Senna."[1]

In a little-known letter, dated Claremont (Mauritius), 26th August 1856, Livingstone writes:—

"I may mention that Dr. Beke, having shown me to-day a sketch of Lake Nyanza by the Rev. M. Rebmann, I find it agrees very closely with a lake of that name visited by a gentleman of Tete (Senhor Candido), which I have put down, on his authority, in a rough map. As we have now information respecting it from those sources, there can be little doubt of its actual existence . . . I would say the main branch of the Zambesi comes out of it . . . it would have been easier to go thither than to come down the Zambesi." And as the result of Candido Cardoso's description, Livingstone places Lake Nyanja, or Maravi, between 11° and 13° S. lat., and the Shiré as issuing from the south of the lake.[2] It is curious to compare the map, referred to, of the first journey, with the ancient Portuguese maps and those of d'Anville (1727-1749), and with some Italian maps of the commencement of this century (Placido Zurla, 1818).

It is not until eight years after Livingstone's first book, that the great lake, formerly in 11° to 13° S. lat., descends to S. lat. 17½°, and become minimised to the *marshes* of Livingstone's second journey.

It was, moreover, under the protection afforded by the influence of the Portuguese A. Henriques Ferrão, and accompanied by his servants, that Livingstone visited the Shiré and its territories.[3]

IV. Here, however, we have a new document of ancient travels which will serve to lead us from the river Shiré to the part of "Nyassaland" between the lake, the Shiré, the sea, and the river Rovuma.

In the early years of the seventeenth century a Portuguese starts from Tete, on the Zambesi, ascends the Shiré, crosses it, passes near the Nyassa, traverses the lands to the east of the lake, follows in part the course of the Rovuma, and journeys as far as Kilwa. Here are a few sentences, merely, from the minute description of this journey, which I judge to be entirely unknown to the greater number of British geographers, and to which, in any case, no modern geographer has hitherto referred.

"Gaspar Bocarro (a nobleman from the house of the Marquis de Fronteira), started from Tete in March 1616 . . . and, passing to the other side of the river Zambesi, journeyed on through the lands of Bororo, etc.," and twenty-five days later "slept at Morumba. . . . Near the city of Morumbo is the great river or lake Manganje, which has the semblance of a sea, whence flows the river Nhanha,[4] emptying itself into the Zambesi below Sena, to which they there give the name of Chiry . . .

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[1] Dr. Livingstone's *Missionary Travels*, 1857, p. 640.

[2] *Vide* Map at the end of *Missionary Travels*, 1857.

[3] J. A. Correia Pereira, *Notas ao Ministerio do Ultramar. Economista*, Sept. 1888.

[4] *Nh* in Portuguese may be represented in English by *ny*.

and he [Gaspar Bocarro] proceeded beside this river Nhanha, and slept on its shores, and the following day crossed to the opposite shore in boats . . . and journeyed north," etc. . . . Nine days later he was on the margins of the Rovuma : " Thence they proceeded and slept . . . beyond the river Rofuma in the place named Muangongo . . . the lands which stretch from this river Rofuma right to the salt sea," etc.

Twenty-eight days later they arrived at Kilwa. And although Gaspar Bocarro spent fifty-three days on the road, yet, his youths, who returned by the same route, from Kilwa to Tete, being smart, only occupied twenty-five days. And the Portuguese historian thus concludes :—" I have written all the details of this road . . . so that, if it is proposed again to try this route," etc.[1] And, between the Rovuma, the sea, Lake Nyassa, and the Shiré, the territories thenceforward were visited by Portuguese or their envoys.

To the east of the Nyassa no European influence dates earlier than that of Portugal. The Portuguese have, for a long time, traded in ivory and tobacco with the country of the Ajawa or Yao, between the Lujende and the Nyassa, so that the quantity of ivory,—brought to the Portuguese fairs, or fetched by Portuguese traders and their agents,—was, at one time, calculated at more than 15,600 arrobas (223 tons) annually.

For this trade a company was subsidised by the Portuguese Government in the eighteenth century (D. José I.). These goods were exchanged for the products sent from Portuguese India, from Goa, Damão, and Diu, or for those of Brazil and Lisbon. I have before me lists of merchandise which was sent from these places to Mozambique, Quilimane, and Tete, and which the Portuguese, or their agents, or those under Portuguese prestige, and following the roads opened by Portuguese, caused to be distributed throughout these territories.

For centuries the elected chiefs of the Macuas, between the Nyassa and the sea, came to solicit confirmation of their title from the Portuguese Government of Mozambique.

Luiz João Gonzaga of Ibo, to give an actual example, has always had close relations with the chiefs of all the territories from the Nyassa to the coast. His agents, his caravans constantly pass through them. Cardoso met them on his 1885 journey, some coming from the Lujenda valley, others from the valley of the Lurio, and from Lomwe.

Mr. Gonzaga was the merchant who gave Serpa Pinto and Cardoso letters to chiefs on the borders of the Nyassa.[2]

Taking into consideration the relations which for centuries have existed from the shores of the Indian Ocean to the Nyassa, the Portuguese writers and the Governors of Ibo speak of the district of Cape Delgado, in the Province of Mozambique, as extending to the borders of Lake Nyassa.[3]

Quissonga, opposite Ibo, has long been the rendezvous for the trade of the interior. The coast population, under Portuguese influence, is

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[1] *Decada* 13*a da Historia da India*, Antonio Bocarro, 1635, Lisbon, 1876, pp. 598-602.
[2] Augusto Cardoso, *Diario de Viagem*, 1886.
[3] Perry da Camara, *Districto de Cabo Delgado*, p. 3.

estimated by Perry da Camara[1] at about 130,000 persons, who by their connection monopolise the whole interior.[2]

Not four years ago, eight up-country chiefs came spontaneously to Ibo, to offer vassalage to Portugal, declaring that they were merely ratifying the vassalage which their fathers had rendered to the King of Portugal.[3] Since then, the caravans, which used to go from the Nyassa to Lindi and Kilwa, north of the Rovuma, have commenced going to Ibo and the Portuguese ports.

The recent prosperity of Mazimbwa, between Ibo and Tungui, is a consequence of these augmented connections and trade. In 1884 one caravan alone brought about £5000 worth of ivory from the interior to that port.[4]

When Serpa Pinto's expedition reached Medo in 1885, the Portuguese flag was flying both at Medo and at Mwalia, almost in the centre of the region extending from the sea to the Nyassa. The history of this expedition and of its journey from Mozambique to Ibo, and from Ibo to the Nyassa, demonstrates the Portuguese prestige in these parts. The chiefs of the tribes obeyed, readily and from a distance, the orders of the Portuguese Governor of Ibo. Serpa Pinto, one of the leaders of the expedition, almost dying, was carefully conveyed back, and the other, Cardoso, who for several days was blind, was guided to the banks of the Upper Lujende, by Checuan, uncle of M'Tarica himself.[5]

M'Tarica, the chief of Lujende, rendered all sorts of services to Cardoso's expedition; he received from him the Portuguese flags which he placed in his prosperous town (the key of the caravan routes from the Nyassa to the sea), and offered vassalage to the King of Portugal.[6] His brother, Kwirrasia, chief on the margins of Lake Nyassa, did likewise.[7]

The Portuguese Government has long had residents with the Medo and Mucaribo chiefs. These residents are not *consuls*, such as Great Britain sends to the Nyassa, as to a country confessedly foreign, but are official delegates of Portugal in a manifestly vassal country, who watch the actions of the chiefs, and frequently direct them.

V. It now remains for me to speak of the travels and explorations of the Portuguese in the final portion of what may be styled "Nyassaland": the regions west of the Lake.

Senna and Tete, towns established in the valley of the Zambesi, about the middle of the sixteenth century, and Zumbo, in the eighteenth century, when all were regarded as "villas" (boroughs) (1763-1764), thenceforward became centres and starting-points for the exploration and trade of the countries north and south of the great river.

[1] Perry da Camara, *loc. cit.* p. 4.

[2] *Loc. cit.*; *Conferencia na Sociedade de Geographia de Lisbôa*, 1886, p. 13.

[3] *Boletim official da Provincia de Mozambique*, Feb. and March 1886, Nos. 9 and 10; P. da Camara, *loc. cit.* p. 41.

[4] Perry, *loc. cit.* p. 8.

[5] Perry da Camara, *loc. cit.*; Augusto Cardoso, *Diario de Viagem. Conferencia na* Soc. de Geographia de Lisboa, 1886, *passim.*

[6] Cardoso, *Conferencia, etc.*, 1886, p. 13.

[7] Cardoso, *Diario de Viagem, Conferencia, etc.*, p. 16.

It is altogether erroneous to say, as English writers constantly do, that the trade there was *exclusively* in slaves. What at this moment occupies us is the commerce north of the Zambesi, and it was precisely from the north that ivory and a great part of the gold was obtained. W. Montagu Kerr says: "Ivory and gold are the coveted treasures of this region (Tete), and, since *the conquest, have formed the chief articles of trade.*"[1] In some statistics of 1806 the annual exportation, then already declining, from Senna and Tete, where the produce was collected, amounted to 10,187 oitavas (1273 lbs.) of gold, 4375 elephants' tusks, besides copper, wax, etc. In 1835, 6000 "oitavas" of gold, and 900 "arrobas" (13 tons) of ivory were still amassed. Even to-day the greater part of the ivory which enters Quilimane is from Tete.[2] In exchange for these the Portuguese introduced Asiatic and European wares to the whole Maravi country.

Many of these lands were, in the sixteenth century, bestowed, by the native chiefs, on the King of Portugal. The establishment of Zumbo has its origin in this very fact, which was commemorated in ceremonies of vassalage, that still took place as recently as the middle of the eighteenth century.

Francisco de Sousa writes:—"All the other lands stretching to the confines of Marave belong to kings and lords who, in the days of the Governor Francisco Barreto, offered vassalage to the Portuguese."[3]

The same author speaks of gold known to, and explored by, the Portuguese, 240 miles above Tete.[4]

Any one casting his eye over a map of Eastern Africa, made from ancient Portuguese descriptions, may see, parallel to Lake Nyassa, and stretching towards the 14th degree of south latitude, a number of places designated *bares*. These *bares*, as every one knows, were localities where gold was worked. Many were discovered or explored by Portuguese in the Maravi country, which, extending to Lake Nyassa, long gave it the name.

There the Portuguese had authority, chief-captains and Dominican missionaries. And for many years, in these *bares*, which Portuguese writers of fifty years ago still called *aldeias volantes* (movable villages), wooden chapels were erected where the monks said mass.

Mochinga, Mixonga, Java, Cansissa, Chinsundo, Missale, Mano, are names of some of these *bares*, the explorers of which used to work more than 200 miles round about to the north of Tete, in the vicinity of the 12th parallel, and west of Lake Nyassa.

From 1825 to 1827 a Portuguese colony was established in Marambo, one degree west of Nyassa, in lands purchased from native chiefs, and the Portuguese traded thence with the Muizas, to the north of the Maravi country, nearly as far as the northern limit of Lake Nyassa.[5]

This colony is still found indicated on Portuguese maps with the

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[1] *Scottish Geographical Magazine*, vol. ii. p. 387. 1886. (The italics are mine.)

[2] Cardoso Coutinho, *Boletim Official da Provincia de Moçambique*, p. 212, 1838.

[3] *Oriente Conquistado*, p. 838, 1710.

[4] *Loc. cit.*, p. 846.

[5] Burton, *Lands of Cazembe*, pp. 30, 50.

designation "*terra portugueza*" (Portuguese land). But, in these same maps, beyond the mountain ranges to the south-west of Lake Nyassa, where stretches what in English maps is styled "the Kirk Range," the following words appear :—"Terras de Chissaca subdito Portuguez" (lands of Chissaca, a Portuguese subject).

These territories, inhabited by the Muzinbos, extended north as far as the river Ruareze, the river Bua, and the margins of Lake Nyassa near Kota-Kota, and westward as far as the mountains of the Upper Shiré Valley.[1]

In the eighteenth century, the Portuguese Pedro Caetano Pereira, travelling through these lands, caused himself to be recognised as chief of the Muzinbos tribe and of the kingdom of Makanga. P. Caetano Pereira was a representative of the Portuguese Government, and his descendants remained such through vicissitudes and rebellions natural and inevitable amongst the peoples and regions of Africa. In 1887, at the request of many of the chiefs of these territories, the Portuguese Government established a military command in Makanga.[2]

Descriptions dated 1859 indicate many places to the west of the Nyassa, and some 180 miles from Tete, where gold was still known and worked.[3]

All this territory, stretching west from Lake Nyassa, was traversed by, amongst others, the Portuguese expeditions of Manoel Caetano Pereira in 1796, of Dr. Lacerda in 1798, of Colonel Honorato da Costa from 1806 to 1811, of Monteiro and Gamitto in 1831-32, and by the expeditions of Silva Porto, which, in 1854, starting from Angola, crossed the Shiré at Tete, passed north of Lake Shirwa, and terminated to the north of the Rovuma.[4]

From what has been stated it will be seen with what amount of correctness a very distinguished English geographer, not long since (May 1888), said—"No Portuguese travellers, previous to Serpa Pinto and Cardoso (1885), explored the interior [of East Africa]." "No Portuguese travellers have added to their [namely, British explorers'] knowledge" [of the Lakes Region of Africa]. "No other nation [but the English] has laboured in the same field" [Nyassaland].[5]

VI. My thesis in regard to all the parts into which "Nyassaland" may be divided being thus proved, it is evident that it may always be retorted that on the exact site, perchance, where at the present moment are located the Blantyre and Bandawé Missions, or where previously Livingstonia stood, or many miles round about, the Portuguese were

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[1] Mesquita e Solla, *Commando Militar da Macanga, Bol. off. de Moçambique*, 1888, p. 214.

[2] Augusto de Castilho, *Boletim off. de Moçambique*, 1887, pp. 331, 332.

[3] Vide *Memorias Estatisticas sobre Africa Oriental e Provincia de Moçambique*, 1835-59; *Diccionario de Geographia Universal, etc.; Portugal, Provincias Ultramarinas e Brazil*, 1881-86, vol. i.-iv., Lisbon.

[4] Vide *Annaes Maritimos e Coloniaes*, Lisbon, 1844-45; P. Gamitto, *O Muata Cazembe*, Lisbon, 1854; *Boletim Official d'Angola*, 1854-56; R. Burton, *The Lands of Cazembe*, 1875.

[5] *Scottish Geographical Magazine*, vol. iv., 1888, pp. 299-301.

not established prior to the Scottish Missions; and the general public, who do not know Africa, and whose judgment is formed by the way in which European districts are possessed and occupied, will, of course, be always much influenced by this argument.

There is, however, between the Portuguese and the British explorations and establishments in "Nyassaland" an essential difference, which has not yet been noted.

Some of the Portuguese stations, existing from the sixteenth century, in the *Bares* of the Maravi country, were military establishments. The colony of Marambo was founded in 1825 in the name of the King of Portugal. It is to Portugal that the peoples to the east of Lake Nyassa, from the border of the Lake to the valley of the Lujende and Medo, have offered vassalage. The Portuguese, who made themselves chiefs of the Muzimbos, did so by military patents granted them by the Government of Portugal. The expeditions commanded by Dr. Lacerda, Pinto, Monteiro and Gamitto, were despatched by the Portuguese Government, as also that sent by Colonel Costa, and the two which have been under the orders of Augusto and Antonio Cardoso.

Doubtless, therefore, in what may be styled "Nyassaland," Englishmen have travelled and settled, but the *British Government* has never been seen, except as represented, ostensibly and manifestly, by consular agents, which a nation always sends to territories not its own.

The Portuguese Government, on the contrary, has, for four centuries, in "Nyassaland," subjugated, restored order, and practised acts of sovereignty.

The trade initiated by the Portuguese may have declined in some districts—may have been transformed in others—may have passed largely into the hands of foreigners (of Englishmen, if you will), but all this represents the continuance of what had been essentially established and maintained, for centuries, at the cost of many struggles, many lives, and great outlay of money, on the part of Portugal as a nation, as a sovereign state. Much, perhaps, of the capital, much of the trade, have changed, because they are things mutable and transitory; but the fixed and permanent authority, that in which resides the sovereignty and political sway, has not changed. That has always been, in this part of Africa, of course under the conditions of possession and occupation alone possible therein, Portugal, and no other European power.

The acts of Portuguese authority were, in many parts of the territory of which we are treating, as evident and effective as was possible in a region like Africa. This does not mean, nor ought it ever to be expected, that Portugal should everywhere therein maintain armies and police; but it does imply that the Governments of the King of Portugal, and of no other European State, have more than once sent expeditions to punish the natives and to protect trade, as, for instance, those of 1804 and 1807, to the Maravi country,[1] and the latest expedition to the Massingiri of the Shiré, or to the territories of Makanga.

I have not said all that I could say on the subject. But it

[1] Botelho, *Memoria Estatistica*, 1835, pp. 265, 266.

remains proved, by facts and documents, that all the rights which result from priority of discovery, priority of exploration and priority of trade, belong, in "Nyassaland," to Portugal. In like manner is it proved that Portugal has, so far, been the only European nation which, as a Sovereign State, has had territories and peoples under vassalage, and has exercised acts of sovereignty in these regions.

March 2, 1889.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

On Monday, 8th April, a meeting of the Society was held in Dowell's Hall, Edinburgh. Dr. George A. Turner, Hon. Secretary to the Glasgow Branch of the Society, read the paper on "Samoa" which we publish this month. Dr. George Smith, who presided, conveyed the thanks of the Society to Dr. Turner for his paper. Dr. George Smith then relinquished the chair to Mr. A. L. Bruce, who announced the receipt by the Society of a letter from Mr. Stanley, which we print as our first article this month. The letter was then read by the Secretary, Mr. Silva White. The lateness of the hour precluded any discussion of Mr. Stanley's communication. The Chairman, Mr. William C. Smith, Mr. W. B. Blaikie, Dr. Mill, and the Secretary, having made some remarks, a hearty vote of thanks was accorded to Mr. Stanley for his valuable communication.

The following evening, at a joint meeting of the Glasgow Branch of the Society and the Philosophical Society of Glasgow, in the Hall of the latter Society, Dr. George A. Turner re-delivered his lecture on "Samoa." Mr. Renny Watson, Chairman of the Branch, presided. Dr. Thomas Muir moved the vote of thanks to the lecturer.

GEOGRAPHICAL NOTES.

AFRICA.

Usambara, East Africa.—Usambara has from time to time been visited by travellers in making their way from the coast to the region of the great lakes, yet very little was known of it until quite recently, when it was explored by the expedition under Dr. Meyer. Dr. Baumann, by whom he was accompanied, has contributed to Petermann's *Mitteilungen* (Band 35, 1889), a paper (and map) replete with valuable information regarding Usambara—its physical features, its climate, its productions, and the various tribes by which it is peopled. It may be described as in the main a mountainous region. The mountains, which are not continuous but detached elevations, form a part of that quartz range which has Kilima-njaro for its northern outpost, and its counterpart in Western Africa in that schistose range which runs parallel, but at some distance inland, to the Atlantic sea-board. The coast of Usambara is in some parts fringed with ascending walls of picturesque rocks overhung with a luxuriant vegetation, but all the rest of the sea-board tract is flat and sandy, and productive of little else than coco-palms and stunted mangroves. In the district of Bondei, which at some distance from the coast stretches northward from the banks of the Rufu or Pangani, the land undulates into low hills, separated from each other by swampy hollows or flats covered with tall grass. These hills, as, for instance,

the Tongueberg, are thickly wooded, but only on the higher slopes. Further north, at Magila, the hills attain a greater height, and show the characteristics which specially distinguish the Usambara range. Numerous streams rise in these hills and find their way to the plains through narrow gorges, the Luengera alone, which is the last great tributary received by the Pangani on its left bank, having a valley of considerable width.

In traversing Usambara lengthwise the traveller finds three regions which are quite different one from the other. First comes, westward from the coast district, the forest zone, which comprises the south-east part of the country in and around Handei, the Sigi basin and the Mlinga, and which, after stretching northward to Kombola and Handu, and thence to the Gondja and Kigongoi mountains, sinks sheer down to the plains below. Throughout this region, the low-lying parts and the slopes of the mountains are densely covered with tropical forests, except at the higher elevations where the forests assume an Alpine character. The chief river of this territory is the Sigi, which has a very considerable volume of water. It rises in Handei, and, entering the plains northward from Mount Mlinga, discharges into a small bay south of the 5th parallel of latitude. Another stream, the Bombe, rises in Kisara, and, flowing northward, passes through the Nyika wastes to join the Umba. The contrast is striking when one suddenly and immediately passes out of this beautiful forest region into the belt of open and more level country. Here the slopes and hollows are everywhere covered with tall, stiff grass, interspersed here and there with solitary trees of stunted growth. The landscape is, however, sometimes agreeably diversified by the appearance of tree-cactuses, gigantic euphorbias, and even forests, which fringe some of the river-courses. These forests are remarkable for their tall lianans and their richness in succulent plants. In the northern district of Iashatu, where the bare and rocky hills of Gomeni crop up, the country is scantily watered, and presents a very desolate aspect. The principal stream of this region is the Luengera, which below Korogwe joins the Rufu or Pangani River. It receives numerous tributaries, and among others the Kumba, which is the most northern, and flows through a wide valley filled mostly with its own alluvial deposits. Below Mshihui it forms an extensive swamp much frequented by the hippopotamus. It has no crocodiles, however, though these swarm in the Luengera. In the north-west of Usambara, which is the region of high meadows, the vegetation is far more luxuriant, and tropical forests again make their appearance. Its mountains, which are the highest in the whole country, rise to a height of upwards of 6500 feet. The meadows are covered with the soft grass peculiar to Europe, and with lowly ferns and various species of *erica*. The river Umba, rising in the north of this region, amid the swamps of Shele, skirts the hill of the large village of Mlalo, and having conquered its way in waterfalls and rapids to the Nyika plain, where it receives several large affluents from the south, enters the sea at Wanga. The other streams which water this region either flow eastward to join the Umba, or southwards to the Rufu. Of the latter, the largest and most western is the Mkomasi, which has its sources in the Paré range in the extreme north-west, where, when nearing Gondja, it forms the beautiful cataract called the Thornton Fall. Its current is sluggish, and often diffuses itself amid swamps. The centre of the northern territory, comprising the district of Kwambugu, may be described as a grassy plateau, hemmed in on every side with high hill-crests, and abounding in streams. The Nyika is all but a uniform plain, noted for its desolate aspect and its scantiness of water. A few low hills, however, and groups of palms, tamarinds, and mimosas, which border the streams flowing to the Umba, serve somewhat to

diversify and enliven the landscape. Regarding the climate of Usambara, Dr. Baumann, on account of the shortness of his stay in the country, cannot speak with much certainty. He says, however, that he never suffered from the heat, but often found the temperature, especially by night, to be quite low. The thermometer fell one morning to nearly 5° Centigrade. The rainy season sets in at the very beginning of October, and earlier in the interior than on the coast. Europeans who repair from the hot plains to the mountains find the air very refreshing, and in every respect salubrious.

The great mass of the natives belong to the Washambâ stock, and only the innermost and highest parts of the country are inhabited by the Wambugu. The Washambà are a branch of the Bantu, and their speech is closely akin to the Kisuega. They are for the most part middle-sized, sturdy highlanders. The women always have their skulls closely shaven, and sometimes the men also, who, however, invariably leave a tuft of hair on the crown of the head. Their wearing apparel is nearly all imported. Even in districts where the members of the expedition were the first white men ever seen, articles of dress, and a variety of domestic utensils, all produced in Europe or India, were found to be very commonly diffused. The weapons of war are the gun, the bow and arrow, the spear, and the sword. The chief occupation of the Washambâ is agriculture and cattle-breeding. The chief article of food is a pleasant-tasting kind of bean, and next thereto a species of millet, from which a thick red pap is prepared. Manioc is often found, and less frequently sweet potatoes and yams. Among other products, plantains, sugar-canes, coco-palms, sour oranges, tomatoes, sesame, rice, maize, pepper, ginger, and tobacco are enumerated. The most common domestic animals are the hump-backed ox, sheep with smooth hair and immense tails, goats, poultry, and dogs of the African kind. Bee-culture is diligently practised by the Washambà, and nowhere more than in the district of Iashatu. The honey is of a dark-brown colour, very sweet and pleasant to the taste. This product, together with butter, tobacco, molasses, beans, and caoutchouc, are the principal exports of Usambara. They are brought for shipment chiefly to Wanga.

Dr. Baumann gives some interesting information regarding the social and political conditions existing in the country. Polygamy is allowed, but is not common except among the chiefs. The women are well treated and virtuous. The slaves are also well treated, and are chiefly employed as herdsmen. The Washambà, till 1867, were under the despotic rule of a king, who lived in Wuga, and whose authority extended to Bondei and the sea-board. Since that time the reigning family, of which individual members are in many cases chiefs in various parts of the country, belong to the stock of the Wakilindi, who resemble the Arabs, and wear the Arab dress. They are not at all popular, and in some parts of the country their authority is but nominal. They uniformly sympathise with the Arabs, and their influence must be regarded as deleterious to the general welfare, while it is directly antagonistic to the views and interests of Europeans. Besides the Washambâ and the ruling race of the Wakilindi, there is a third element in the population of Usambara well worthy of notice—the Wambugu, who inhabit a northern district called Kwambugu, and can at a glance be distinguished from their neighbours. They are a tall, slight-built people, with sharp-cut features, which remind one of the Indian type. In many respects they resemble the Masai, but their speech is a dialect of Bantu. Altogether, the position, soil, and climate of Usambara combine to give the impression that it offers a most suitable sphere for European colonisation, and that, subject to this contingency, it has a very promising future.

AUSTRALASIA.

British New Guinea.—Mr. J. P. Thomson, our Honorary Corresponding Member at Brisbane, writes to us, under date 9th February 1889, as follows :—

"Latest official despatches from British New Guinea give a detailed account of the operations of the Hon. W. M'Gregor, C.M.G., Her Majesty's Administrator of the Government of British New Guinea.

"Immediately after the proclamation of sovereignty over the formerly protected territory of British New Guinea, his Honour the Administrator proceeded, on the 21st September of last year—first, overland from Port Moresby to Kerepunu, taking an approximate census, as hereunder, of the following villages, viz. :—Tupuselei, 300 ; Kaile, 300 ; Hula, 1500 ; Kamale, 100 ; Badaka, 350 ; Kerepunu, 1000 ; Kalo, 2000 ; Rigo and Sarua, 4000 ; Quaipo, 1000 ; Garia, 3000. The area they occupy is about 1000 square miles. Thence he proceeded in the schooner *Hygeia* to the south-eastern section of the British possessions in New Guinea waters, where the islands, whose names and descriptions here follow, were extensively explored and minutely inspected by the Administrator in person :—

"St. Aignan Island.—This island comprises an area of over 100 square miles ; its length is about 29 miles, varying in breadth from about 8 or 9 miles, at the east end, to a narrow range of mountains about a mile broad at the west end. Practically the whole island is covered by forest, excepting small areas of cleared patches, where gardens have once been planted on some gentle slopes and undulating country at the east end. The island in general is very mountainous, the base of the hills terminating in the sea. The west end consists of a mountain-range named Lakia, 3500 feet above sea-level, and composed of a schistose slaty formation, which at many points projects into the sea, exhibiting, as at various parts on the mountain face, huge slabs of the slate rocks. The eastern section of the island is composed of extremely rugged hills of from 1000 to 2000 feet high, separated from one another by very deep narrow glens and gorges. These hills appear to have been formed mainly by volcanic action, many of them being chiefly limestone, which appears to be altered coral, and with this are great masses of conglomerate, formed apparently from shingle, and these again are mixed with broken layers of schistose slate of the same character as the slaty formation of Sudest, Rossell, and Joannet, containing quartz of the same character also. Round the greater part of the coast there is a fringe of raised coral, on the east side sometimes rising to upwards of 100 feet above the sea, to which it presents a perpendicular or undermined wall, full of fissures and deep excavations. The erosive action of mountain streams has in many places cut passages right down to sea-level through the coral wall. On the west end the coral fringe is either absent altogether or present only in a much less marked manner than on the east end. The island is not protected by a sea reef, and consequently no good harbour could be seen. Taking into consideration the extremely rough nature of the country, the island is thickly inhabited. The population, which is probably about 3000 souls, is located in thirty villages, the largest of which contains about eighty houses. Many of the villages are so unfriendly with each other that a fear of being killed prevents an interchange of courtesies. No indication of cannibalism exists ; but it is quite clear that they are head-hunters. They suspend the skulls of the vanquished on or over the verandah in front of the houses, sometimes along with the right arm of the victim. Some houses are decked with three or four skulls ; all of those seen

were of natives. They bury their dead relatives under the houses, as at Port Moresby. In the gardens they plant yams and taro, besides which they have pumpkins, sugar-cane, sago, two kinds of edible pandanus, bread-fruit, and some forest fruit. They also have a few fowls and some pigs, who appear to be well fed. The absence of a sea-reef prevents the inhabitants from enjoying the luxury of fishery of any kind ; and although the soil is very productive, yet it is too rough to permit of their becoming cultivators for export. Some good timber might be exported, but at present the island affords no prospect for any considerable export trade in anything. The men appear to perform the greater portion of the work of planting and carrying. Polygamy is allowed, and wives are obtained by purchase. Although they believe in witchcraft they seem to have no belief in a future state. They have entered the iron age, and appear to have entirely given up the use of the stone axe, except as a medium for purchasing wives. Their clothing consists solely of pandanus leaf. They are a healthy race, but three-fourths of them suffer from severe ringworm. Leprosy does not apparently exist amongst them, and phthisis is rare. The language of St. Aignan bears but little resemblance to those of the neighbouring islands. It is replete with words terminating in consonants, chiefly with 'an' and 'ak.' In counting they repeat the first five numerals, but have distinctive words for the decimal numbers. They have the same complicated declension of the pronouns which is common to the whole of Polynesia.

"Joannet Island.—The island of Joannet is situated a few miles from Sudest, and contains an area of about 25 square miles. It is hilly, the highest points being from 800 to 1000 feet above sea-level. The formation is slate, with veins of quartz. It has been at one time all covered by forest, but extensive clearings have been made, which are now covered by spear grass, so that about half the island is clothed with forest. The soil, although not rich, supports grass well, and there is plenty of water for pastoral purposes ; the timber is, however, of little value. Near the middle of the island there is a marsh about a mile and a half in diameter, which would make a fine rice field. In the creeks and gullies there are small clumps of rather inferior sago palms, and small patches of pandanus. These, with a few coco-nuts, seem to constitute the chief food of the native inhabitants. The population is very small, probably not more than could live in one small village. In type these few natives are inferior to those of the neighbouring islands ; they have irregular features, are ill-fed, and miserable in appearance. Traces of gold were found in creek gravels, but no indications were seen in the quartz rock.

"Normanby Island.—The island of Normanby, which comprises an area of about 350 square miles, is a somewhat irregularly L-shaped mountain-range, with deep furrowed sides, and in some places wide valleys, excavated by the erosive action of the water, occasionally so broad as to almost divide parts of the mountain range into separate mountains. The greatest breadth of the island is about ten or twelve miles, and the highest points of the range are from 3000 to 3500 feet above sea-level ; in the southern and eastern end they rise gradually from the sea ; in the northern and western they are more steep and abrupt. Although the island appears to be delineated on the Admiralty charts with a fair approximation to correctness, there are, however, many alterations of importance which will be made on survey. For example, the so-called Harris Island was found to be only a long, low flat of the mainland of Normanby Island. This island, which possesses no barrier-reef and hardly any trace of shore-reef, is, except at a few places, surrounded by deep water, and consequently possesses no

fisheries of any kind. The whole of the island is wooded, excepting a large mountain near the middle, which is high, bare, and rocky, almost entirely destitute of forest, and appearing to grow hardly any grass. The natives clear patches in the forest for planting purposes. The soil is very rich, being a dark-brown mould resting on clay. The geological formation of the south-eastern end of the island is slate, which in point of hardness varies much in different places. On the surface this slate becomes soft, and lies below the covering mould as a kind of clay, friable and disintegrating. In the bottom of water-courses, in deep creeks and gullies, it is seen to be of a dark colour and firm texture, as hard as basalt, usually lying in layers a few degrees from the horizontal. Between the thin layers of slate are a great many nodules and veins of quartz ; the latter are hard and crystalline, white in colour, and without any marked deposit of any compound of iron or other metal. Indications of gold were found in some of the creeks and water-courses of this south-eastern part of the island, but none were found in the rock. The middle portion of the island presented the same formation as that of the eastern end, but the slate appeared harder, the quartz less abundant, and an additional kind of rock—apparently a kind of dolomite—was also observed. Traces of gold were also found here. For several miles north of the point marked Harris Island on the chart, the formation is entirely igneous, consisting mainly of limestone, in which can be seen distinct traces of coral texture, and sometimes, high up on the hills, great clam-shells are to be seen imbedded in the rocks. In some of the river-beds in this part of the country there are also large beds of basalt, and boulders of siliceous stone. The mountains at the north end of Normanby, adjoining Dawson Strait, and facing the great island of Fergusson, seem to differ much in formation from the south-east and middle portion of the island. The rocks consist of a sort of porphyry; and with this there is mixed in the creek beds some quartz boulders. This formation showed indications of tin, and enough was observed of this part of the island to make it desirable to have it thoroughly examined. The population of the island is very dense, probably numbering not less than 6000 people. They all appear, however, to be remarkably healthy. Probably about a fourth of the whole population suffers from ringworm, and the young children are affected by a very mild attack of yaws ; but itch, leprosy, phthisis, fever, ophthalmia, and elephantiasis appear to be all but absent. The natives plant chiefly yam, also taro, sugar-cane, sweet potatoes, and bananas. The Chinese banana and the sweet potato were here observed for the first time in these islands. The natives are very fond of ornamental plants about their houses, and in most of the villages were a few showy amaranths, crotons, and hibiscus. Some of the men wear bits of masoi bark on a string round their neck, but they say it does not grow here. The Papuan type is well seen in these people. Most of the men have great mop heads of black frizzly hair, but there are a few individuals with wavy hair, and these generally have coarse, irregular features. The men wear only the usual band of pandanus leaf, tied before and behind into a girdle consisting of several turns of a cord round the waist, made sometimes of human hair ; they are not tattooed, but frequently smear black lines on the face with some dark pigment. The women wear grass petticoats from the waist to the knee, often of great thickness. Some of them are tattooed. The smallest boys and girls are dressed in the same manner as adults. The pig and the dingo were the only domestic animals observed among them. Most of the villages visited showed indications of the head-hunting propensities of the inhabitants. It appears to be not improbable that minerals may be worked to advantage in the southern and northern sections of Normanby Island.

"Fergusson Island.—Fergusson Island, which is oblong in form, about 17 miles broad, and about 30 miles long, containing an area of probably over 500 square miles, and longitudinally extending in a general direction of south-east and north-west, is the largest island of the D'Entrecasteaux Group, situated between Normanby Island on the south-east, and Goodenough Island on the north-west. The island possesses three great mountain masses. The north-east corner contains the great mountain of Kilkerran, which attains an altitude of probably not less than 6000 feet; the north-west corner is formed by the Maybole range of mountains, whose loftiest peaks rise to a height of about 5000 feet above sea-level; the south-west corner is occupied by a great range of mountains whose altitudes vary from 3500 feet to 4000 feet, ending in Cape Mourilyan. The south-east corner is of irregular outline, covered by several low hills, which extend out to sea so as to form a number of deep bays. The formation of the Kilkerran and Maybole ranges is the same, consisting principally of micaceous schist, with veins and nodules of hard white quartz enveloped in it. But in the beds of creeks and water-courses there are boulders of quartz and masses of rock of slaty formation, containing a large admixture of silica, so that it sometimes resembles sandstone to some extent; while some masses have a grey colour, and appear like porphyry. The south-east corner of the island is entirely of igneous formation. The prospecting miners, accompanying the Administrator, examined the two mountain ranges (the third mountain range could not be examined) of the north-east and north-west, but no traces of gold were discovered on the island. The mountains are so precipitous that alluvial deposits of gold could not form unless towards the centre of the island, which was not visited; but the general appearance of the island, tested in various places by actual examination, showed that the existence of gold, in any part, was highly improbable. It has no barrier reef, and consequently the inhabitants have no important fishery. The coast of the island, from the east end of Dawson Straits to Mount Kilkerran, is composed of volcanic hills, with valleys of considerable extent between them, all wooded, and with few appearances of habitation on the coast; but the southern and eastern slope of Mount Kilkerran from the sea half-way to the summit, was found to be fully populated; the upper half of the mountain is covered by forest, and the lower half by native plantations. The side of the mountain facing Hughes Bay is very steep; nevertheless there is a number of villages on it at altitudes varying from 500 feet to 1500 feet above sea-level. There are no villages on the coast here, nor in Hughes Bay. The soil in general is very fertile, and consists chiefly of a brown and rich chocolate-coloured volcanic mould containing pumice-stone. The natives, who cultivate extensive gardens, plant chiefly yams, taro, bananas, breadfruit trees, and sugar-cane. The existence of crater walls, saline lakes, and thermal springs on the island are indications of its volcanic origin. The side of Mount Maybole forming Hughes Bay is inhabited by natives whose villages are scattered on its slopes up to a height of 2000 feet. Search was made, at Cape Labillardiere, for the hot springs marked on the Admiralty chart, but no traces of them could be found. In Seymour Bay, which lies on the south-west coast between the Maybole range and Cape Mourilyan, saline lakes and several small hills, giving forth copious sulphur fumes, were discovered in a large area of flat swampy land opposite the bay. There are no villages on the low swampy ground, but there are many on the mountain ridges on the north and south sides of the bay. So powerful are the exhalations of the sulphur hills that the smell was distinctly felt on board the Government schooner during the night, although anchored a mile and a half in a direct line from the nearest spot giving

issue to these, and in the morning there was a brown coating on the white painting of the vessel. During the day these vapours are decomposed and dissipated by the sun's rays, but at night they again accumulate like thick haze or light mist in the hollows at the foot of the mountain range, and, gradually spreading out, lie low over the whole bay, so that it is very surprising they have not been discovered before. A lake was visited, and some boiling springs, at the south end of the bay, about a mile and half from the sea. The lake there is, at present, about 10 acres in area, but is at times of less drought evidently considerably larger. It is shallow; the water is of a brown colour, tasting strongly of alum, etc. Into it fall two small creeks, one containing fresh water fit for drinking, the other water that at some places is hot and saline. At one side of the lake there is a small hill about 100 feet high, the side of which next to the lake is covered with small openings and fissures from which issue large quantities of sulphur fumes, the sulphur from which is deposited in a pure crystalline condition. At several places along the foot of this little hill there are small subterranean cavities containing liquid matter of some kind which can be heard to boil briskly; and a boiling spring of water is visible at one end of the hill in the midst of a number of small vents fuming with sulphur vapour. At the other end of the hill, at a height of about 30 feet, there is a chimney-like, circular cavity about 10 feet in diameter, at the bottom of which, at a depth of 10 or 12 feet, there is a boiling, steaming mass of mud and water, part of which occasionally is projected over the side of the opening by the violence with which it boils. Near to the lake there is, on the north side, a tract of flat land, covering about 40 acres, which in certain places emits large quantities of sulphur fumes; but at this point water is absent. There are not any extensive deposits of sulphur in the locality. It is deposited in the crystallined condition, so that it will be washed away by heavy rains. In some of the deposits a considerable amount of impure alum appears to be present. On the north side of the bay, about a mile and a half from the shore, a saline lake was found, beautifully situated between low, wooded hills, covering an area of about 40 acres. It appeared shallow, and its waters tasted strongly of alum and salts. In the evening light the water presented a pale green colour. Near this lake there is a small hill about 150 to 200 feet high, and probably three-fourths of a mile broad, nearly round in form. This may have been a small active vent at one time, as it is rather hollow near the centre. All round its circumference there are fissures and small tubular-looking openings, emitting large quantities of sulphur fumes. As on the small hill and sulphur field, on the other side of the flat, sulphur is here deposited in a pure crystalline form. There are also about the foot of this hill small boiling pits, most of them subterranean. The quantity of sulphur fumes emitted here is greater than near the other lake, but it is so fine, and the sides of the hill so steep, that it will always be washed away by heavy rain. In the middle of the flat country between the two lakes before mentioned, there is a small rivulet, in the course of which there are places at which hot and sometimes boiling water, impregnated with sulphurous matter, rises. There are very probably other places along this flat country, or in the district south of this bay, containing saline lakes, boiling springs, etc., but it would require at least two or three weeks to examine the country even roughly. It seems to be by no means improbable that this bay, which is only about 150 miles from Samarai, and possessing excellent anchorage for shipping, may at some future time be utilised as a health-resort. The total population is about 6000 souls. On the whole, they are a healthy race of people, although they suffer from the loathsome form of ringworm becoming so prevalent in these islands.

Their only domestic animals are the pig, apparently indigenous, and the dingo. The orange family is not represented on the island, and the inhabitants possess no corn, cassava, or bean. Head-hunting appears to exist in some of the districts, as evidenced by the existence and display of human skulls on the house verandahs.

"Goodenough Island.—A mountain range, extending nearly north and south, comprises the central and greater portion of this island. Two of its summits, near the northern extremity, attain an altitude of not less than from 6000 to 7000 feet above sea-level. Between the southern section of this mountain range and the sea there is a plain which, at its widest part, extends to a breadth of seven or eight miles, cleared of forest, and used by the natives for food-planting purposes. The mountain slopes and contiguous plains contain some good soil, which is cultivated and planted with yams, in small mounds on the flats and on terraces on the steep sides of the mountain ridges; the lower sides of the terraces being sustained by stone walls, which in several places are built round the gardens to a height of 4 feet,—the only instance of a similar kind observed in British New Guinea. The formation is slaty schist, containing, in places, large quantities of mica, and a good deal of quartz; but in the creek beds and on the ridges there are fragments of igneous rock. In the straits some projecting points of this island are of purely volcanic origin. The furthest advanced point into the sea contains, near its end, a small vent, which has probably not been very long extinct. It had been about 150 yards in diameter at the mouth, and about the same in depth; a mass about 80 feet deep and about an equal breadth at the top has been blown out at the orifice, and away to a distance of 70 or 80 yards from its base. A number of coco-nut and other trees, of an age not less than forty or sixty years, grow at the bottom of the orifice; the small hills in its locality are chiefly of igneous formation, and limestone caves exist on the spurs of the main mountain range that are nearest to this volcanic region, all of which lie opposite to Seymour Bay, of Fergusson Island, where the boiling springs and sulphur exhalations, before described, exist. The villages are clean, and the houses comfortable; food is cooked in clay pots of native manufacture, and the inhabitants seem to fish a good deal. As on the neighbouring islands, head-hunting appears to exist, and men and women clothe themselves after the fashion of their neighbours. Although suffering much from ringworm, the people are healthy, and they have neither leprosy, elephantiasis, itch, nor ophthalmia. They possess a few canoes, but they are practically a bush people. The natives of this island were less suspicious than those hitherto met with, and their demeanour was so quiet and friendly that they created a very favourable impression on the Administrator. Excepting the dingo and the pig they have no domestic animals. As on the neighbouring islands, the houses are built on posts, four or six in number, about 5 or 6 feet from the ground, on well selected ridges; the roofs are curved and rest on a lath floor. The number of the population, which is dense, could not be ascertained.

"Goulvain Island.—This island lies between Normanby and Fergusson, at the head of Dawson Straits. It is of volcanic origin, and in the centre there is an extinct crater about 500 feet in height, and much resembling, in its general characteristics, the crater, which is about two miles distant, on Fergusson, on the opposite side of the strait. The island is about 5 sq. miles in area; the flat country and low hills on the south side are covered with coco-nut trees, and densely populated. There is not sufficient cultivable land on the island for the support of a population little short of 1000 souls, but they probably plant with

the inhabitants of the east coast of Fergusson, whose language they speak, and with whom they are evidently closely related.

"Welle Island.—This island is situated east of Fergusson, and contains an area of about 25 square miles. It is low-lying, of volcanic origin, and probably in no part exceeds a height of 300 feet. The population is about 250, and, although efforts were made, no friendly relations with the natives could be established."

NEW BOOKS.

A New Geography on the Comparative Method. With Maps and Diagrams. By J. M. D. Meiklejohn, M.A. London: Simpkin, Marshall and Co. St Andrews: A. M. Holden. 1889. Pp. 492. *Price* 4*s.* 6*d.*

Professor Meiklejohn has constructed a text-book on definite educational principles. Such a work is welcome, and we gladly direct the attention of school-teachers to it. Were this an educational journal it would be our first duty to congratulate the author on his success, and to recommend his volume with confidence as the freshest, most mind-penetrating, and adhesive treatise on geography in existence. No one can read it without lively pleasure, and the succession of brilliant comparisons and intense contrasts between countries and peoples must impress the brain of the dullest scholar. The manner of teaching adopted may be described as a crystallisation of that used in Messrs. Blackwoods' *Geographical Readers*, of which Professor Meiklejohn was editor, and the matter of these *Readers* is to be recognised here and there in the larger work in a new setting, and expanded in a satisfactory manner. Two instances of vivid description, and also of a mannerism that grows a little tedious by iteration, may be quoted :—

"A land of endless variety—of hill and dale, mountain and plain, forest and river; a land of the most varied scenery; a land of many different peoples and nationalities—European and Asiatic, German and Magyar, Italian and Slav, where there are twenty different languages spoken, and half-a-dozen different coinages in use; a pudding-stone of states; a conglomerate of duchies, grand-duchies, kingdoms and principalities; an empire-monarchy with an emperor-king—such is Austria" (p. 129).

"Spain is the land of contrasts. Once the most powerful state in the world, it is now one of the weakest. A land of heavy rainfalls, and of districts that are deserts from drought, of great river valleys and small rivers, of temperate and tropical fruits, a land which contains the hardest working and also the laziest among mankind, where the smuggler is an honester man than the official who arrests him, where even the lower classes are eloquent and noble-mannered —such is and has long been the country we call Spain" (p. 207).

The description of Italy reads like a poem, and contains five poetical extracts in its eleven pages.

The typographical arrangement, in three sizes of type, is beautiful to look at, and worthy of Messrs. Constable; but the passages in the smallest type of all are trying to read—a difficulty which the author himself must have experienced in the medium type, as he has passed over such serious misprints as "silk" in place of "ink," "streets" in place of "sheets," "cold" in place of "solid," and "1390" in place of "390."

It is our part, however, to look at the geography rather than at the literary setting. In this text-book accuracy is subordinated in many cases to interest,

and a fact is less respected than a telling contrast. To take an example from the text, it seems to us that a student applying the "comparative method" would be puzzled by such parallel passages as "At Chirra Poonjee in the Khasia Hills the actual rainfall has been 615 inches" (p. xxv.), and "Chirrapoonje in the Cossya Mountains . . . is the rainiest spot in the world. The annual rainfall amounts to about 610 inches" (p. 234). There are many similar inconsistencies, *e.g.* Kiev and Kieff, Kiachta and Kiakhta; and, though we fully recognise that this defect arises from one of the chief excellencies of the book, the collection of facts and telling instances from many sources, and the repetition of the same thing in several ways, we none the less feel that far more careful editorial supervision was required than has been given. The comparisons and contrasts, although generally good, are sometimes far-fetched. "The electric shining of its waters" in speaking of the sea, "the icebergs sent out by the Antarctic contain a much larger amount of cold than those of the Arctic," and "water cannot take in as much heat as land," are phrases which are scientifically incorrect.

A book published in 1889 should not refer to slaves in Brazil without noticing their emancipation, nor to the international railway in the Balkan peninsula without mentioning its completion, nor ought it to speak of Western Australia as having no Parliament of its own; but these and many other facts are not mentioned.

The Government Year-Book. Edited by LEWIS SERGEANT. Pp. viii., 550. London: T. Fisher Unwin, 1889. *Price* 6*s.*

Political Geography is one of the time-honoured divisions of geographical science. But in this excellent *Government Year-Book*, the politics are clearly a maximum, the geography a minimum. The editor has a definite aim—to exhibit the principal forms and methods of government in each particular State, and to give a yearly review of the most striking contemporary events; and, so far as we have observed, this aim is very fairly carried out. Great Britain and her colonies and dependencies come first (to p. 167); then all the Republics (167-279); next all the Monarchies (279-461); while the annual survey of events, followed by an appendix and index, occupy the rest of the work. The geography in the work is practically limited to the briefest mention of boundaries, area, and population. The main ethnographical facts are sometimes added, but not always: thus, under Russia, it is not indicated that the total population is not homogeneous, but contains elements as various as Poles, Finns, Tartars, not to speak of the distinctions between Great Russians, Little Russians, and Russniaks. We venture to note a few defects which might with advantage be removed in a subsequent edition. Misprints are very few; but to that category belong Holstien (p. 324), Luneberg (331), Altenberg (352), Hakodato (375), Geneva (for Genova, 367), Oubrangi (304), Autofagasta (172), Aitchinese (513), Valletta, Assuncion. It is difficult to obtain uniformity of spelling in Indian names, but it is inconvenient to have Scinde and Sind indifferently for the same province; Sir William Hunter's *Gazetteer* might be consulted. In a book specially dealing with peculiarities of government and political relations, one expects to find in the list prefixed as contents the names of principalities like Liechtenstein and Monaco, the latter of which does not appear even in the index. San Marino has as good right to appear in the contents as Andorra; and why is Tunis entered as a monarchy, when Egypt is not? In the body of the book there are sections on the Channel Islands and on Man; but from the five or six casual references to Scotland, it would be impossible to guess the sharp differences in law, administration, etc.,

which still distinguish North Britain from South Britain. This in such a work is a serious omission. The great State of Mexico deserves fuller treatment than can be afforded by one and a half pages, if Guatemala is to have two and a half pages. Is not *Mahomedan* an awkward compromise between *Mahometan* and *Mohammedan* or *Muhammadan*? What is meant by saying that "the Austrian frontier artificially divides Germans from Germans, Czechs from Czechs, Slavs from Slavs"? Are not the Czechs amongst the purest of Slavs? or, if by Slavs the Slavonians of the province of Slavonia are meant, the statement should be completed by adding that the same frontier divides Poles from Poles, Ruthenians from Ruthenians, Wallachians from Wallachians, Italians from Italians. And is it the case that there is any considerable number of Czechs anywhere outside of Austria? Outside of Bohemia there are many, of course —as in Moravia. It is long since we have seen so decided a plea for a return to the system of transporting convicts "to thinly-populated or unpopulated districts under British control." One wonders in what part of the world the tracts are to be found where the old evils attending the system would not reappear. But the book is a good book, and contains much that would not readily be found in such convenient and lucid shape. Few will, for example, have noticed that between 1882 and 1887 an important social experiment in the reclamation of vagrants and tramps has been carried out so systematically in Germany; that in that period no less than sixteen industrial establishments have been set on foot, providing work and maintenance for 400 persons annually in each institution (p. 351).

Midnight Sunbeams; or, Bits of Travel through the Land of the Norseman. By Edwin Coolidge Kimball. Alexander Gardner: Paisley and London. n.d. Pp. 279. *Price* 6*s.*

Every year sees the number of tourists bound for the Scandinavian countries increase in number, all of whom want information about where to travel and how to travel. Of course they have the guide-books, most excellent things in their way. But guide-books do not give you personal experience, and the information acquired by that means is very often precisely the kind of thing that an intending traveller stands most in need of. Mr. Kimball's book is one of this description. In temperate, sensible language, the writer, an American, describes the route he followed from Lübeck by way of Copenhagen, Stockholm, Throndhjem, and Molde, to the fjord and fell country of western Norway. His book will be found a useful adjunct to Baedeker, or Wilson, or Jörgensen; and, read either before or even after a trip to the north, can hardly fail to prove interesting. The descriptions of the scenery are sympathetic without being overdone; the practical information is pertinent and to the point; the language of the book is clear and easy; the book itself is neatly printed and bound. We have, however, noticed a few slips—typographical and others, such as *været* for *været* on p. 161, and *smuke* for *smukke* on p. 197; on p. 262 the sentence, "The situation of the city is very picturesque, being built along the harbour, &c.," makes one ask how do they build *situations* in Norway? and on p. 190 the writer fails to make it clear that the Norwegian *faste* applied to the posting stations has nothing to do with the English word *fast*, but means *fixed*, and is intended to signify that at the stations so denominated, the postmaster is bound to keep a fixed number of horses in readiness for the use of travellers. But these are only minor points. We certainly recommend all who intend visiting the Sogne, Hardanger, Nord, and Geiranger Fjords, and think of extending the trip to

the North Cape, to read this useful little book before they start, and even before they begin to study that intricate puzzle, Baedeker's *Norway and Sweden.*

Meyer's Konversations-Lexikon. Vierte Auflage. XII. Band: Nathusius —Phlegmone. XIII. Band: Phlegon—Rubinstein. Verlag des Bibliographischen Institute: Leipzig, 1888-1889. Pp. 1028 × 2.

These two volumes cover the ground between the beginning of *N* and the end of *R.* Amongst the more important articles may be enumerated those of the News, Norths, Osts (Easts), Niederlande (Holland), Niederländisch-Indien (Dutch East Indies), Norway, Oesterreich (Austria), Ostindien (India), Oströmisches Reich (Byzantine Empire), Ozeanien (Oceania), Palestine, Paraguay, Paris, Patagonia, Persia, Peru, Poland, Portugal, Prussia, Rhine, and Rome. All these are not equally well done, though there are none but what contain something, and most of them a good deal, to praise. The map for Norway and Sweden is postponed till the volume containing this latter country appears, and that of Portugal and Spain is likewise deferred to Spain—an inconvenience to those readers who in the meantime desire to study Norway or Portugal. In Persia we have an excellent account of the ethnographic complexity constituted by the inhabitants, but no historical map of any of the ancient empires, a want which is also noticeable in the case of Egypt (*vide* Ägypten). It is true that under Alexander there is a map of his empire, which, of course, embraces Persia; but what is that among so many—Persian Empires? The same fault cannot, however, be alleged against the article Römisches Reich (Roman Empire), which, like Greece, has been adjudged worthy of a map showing the ancient countries included under that name. The history of the modern states, Austria (which also has an ethnographic map: a very useful adjunct), Poland, and Prussia, is also elucidated cartographically. Under Poland, by the way, we have failed to read any physical geography; being referred therefor to the articles on the several governments, which is scarcely satisfactory in a work of reference of this rank. Perhaps, however, we may look for a general account under Russia. We are glad to notice that the boundary of Ecuador, as shown on the map of Peru in vol. xii. coincides more nearly with the actual boundary (disputed and unsettled though it be) than that indicated in the map of America (South). There is an excellent article on the Rhine, in which its commercial importance meets with full recognition. The article Portugal, by quoting statistics of 1878 and 1870—the latest available—suggests the inquiry, How far is it advisable or instructive to give statistics for a single year in the case of articles of this description? One thing is at any rate certain, that some of the non-European states are a long way ahead of Portugal (and we may add, Spain) in energy and promptness in the collection of statistical information. Witness in these volumes the articles on Rio Grande do Sul, one of the most thriving of the southern provinces of Brazil; Rosario, in the Argentine Republic; and the Dutch East Indies, where the information is brought down to 1886 and 1887, the oldest date being 1883. The article on Polar Light is accompanied by a series of coloured plates, showing the form and tinting of the Aurora Borealis as seen from different stations in Northern Europe. As Meyer's *Konversations-Lexikon* does not exclude living writers and other eminent personages, the table at the end of vol. xiii. of such men who have died during the publication of the work (*i.e.* since that of vol. vii., when the first list appeared) will be extremely welcome to the reader. This does not, however, mean that there is any falling-off in these columns as compared with those which have preceded them. So far as we have tested, the same high standard of excellence and of completeness is well maintained.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE COCOS-KEELING ISLANDS.

By H. B. Guppy, M.B., F.R.S.E.

Part I.

Although these coral islands have become familiarly known since they were described by Captain Fitzroy[1] and Mr. Darwin half-a-century ago, a detailed account of them has never been published. They have afforded materials for the pens of numerous visitors and sojourners, amongst whom I may mention Keating[2] and Van der Jagt[3] in 1829, and Forbes in 1878.[4] The northernmost island, however, has never been described, and I was fortunate to have the opportunity of visiting it.

My principal interest in these islands lay in their characters as coral islands, and here I was surprised to find that the description given by Mr. Darwin in his work on *Coral Reefs* was a very general one, and by no means a detailed account. During the ten days' stay of H.M.S. *Beagle* in this atoll in 1836, her young naturalist was also occupied in making notes and collections of the fauna and flora, so that but a moiety of his time could have been devoted to the observation of the coral reefs. In truth, when one reflects that this large atoll is about 25 miles in circumference, and that it possesses about two dozen islands and islets, of which the two greatest have a sweep of 6 and 5 miles, it will be at once perceived, as I found in my own experience, that a visit of several weeks is required for its satisfactory examination. Thus it was that in his few days' sojourn Mr. Darwin overlooked some of the most important features of this atoll, and fell into some errors which would have disclosed themselves to him had his visit been greatly pro-

[1] *Voyages of "Adventure" and "Beagle,"* by Fitzroy and King. London, 1839. Vol. ii. Darwin's *Journal* and *Coral Reefs*, and vol. iii. of *Voyages of "Adventure" and "Beagle."*

[2] Holman's *Voyage round the World*, 1835, vol. iv. p. 371.

[3] *Verhandel Bataviaasch Genootschap der K.*, Deel xiii. (Batavia, 1832).

[4] Forbes's *Eastern Archipelago*, Chaps. ii. and iii.

longed. Even during my stay of ten weeks in these islands, from August to October 1888, I left much to be done, although I examined every island and islet, and spent many days in exploring the lagoon.

It is singularly appropriate that through funds supplied by Mr. John Murray, the author of the rival theory of Coral Reefs, I was enabled to take advantage of the offer of Mr. G. C. Ross to visit the only atoll that Mr. Darwin ever examined, and but for which he would never have advanced his theory of subsidence. Through my agency Mr. Murray has been able to meet his opponents on their own ground, and to point out that a brief and incomplete examination of a large atoll, unaided by any other acquaintance with this class of reefs, formed the key of Mr. Darwin's position.

After these preliminary remarks, it would be more fitting perhaps to at once proceed to the proper matter of this paper; but in truth my collections are not yet examined, and my notes are not yet fully digested, and it is due to the courtesy of the Editor that I am enabled to gain time for these purposes by contributing my observations in the form of a series of papers to this Magazine. In consulting the works of the early voyagers and hydrographers of the last century, I have come upon an old plan of these islands; but as my researches are not yet complete, I will defer my remarks on the discovery of this group, and will occupy this paper with some general remarks on the climate, and other miscellaneous matters, together with a description of North Keeling Island, an island never before visited by a naturalist.

The Climate.—The Cocos-Keeling Islands possess a climate that for its salubrity cannot be excelled within the whole belt of the tropics. Although this small group lies only 12° south of the Line, one can live for the greater part of the year under conditions comparable to those of a fine summer day in Southern Europe. Previous to the recent introduction of beri-beri, now disappearing, sickness was rarely known in these islands, the inhabitants nearly all dying at an advanced age. The half-starved and stunted Javanese coolies, who engage themselves for a term of service on the coco-nut plantations, become in a couple of years plump, vigorous, and well-looking; and their wives, wont only to bear a family of three or four children in their native land, here rear up families of eight or nine. The South-east Trade prevails for 300 days out of the year, and under its bracing influence sickly Europeans have rapidly recovered their usual health. The hot close nights of the tropics are here an uncommon experience; and that continual perspiration, which is generally the bane of existence in these latitudes, is an inconvenience only rarely undergone. Malaria cannot linger in these islands, the searching blast of the Trade being its most powerful foe.

As this atoll has been placed under the British flag, I think it my duty to call attention to its salubrious climate, and to its suitability as a sanitarium, especially for tropical invalids, and also for patients suffering from some forms of consumptive diseases. For most of the following particulars I am indebted to the kindness of Mr. G. C. Ross, the owner of the islands, who placed at my disposal his journals between 1883

and 1886. I also kept a register of the temperature and the wind during the period of my visit, which commenced on August 13th, 1888, and lasted about ten weeks.

The temperature[1] throughout the year is but partially influenced by the seasons. However, the winter months, June to September, when the South-east Trade blows freshest and steadiest, are naturally the coolest. During this period the usual daily maximum temperature in the shade varies from 78° to 80° (Fahrenheit), and the minimum temperature from 73° to 74°, whilst only in six or seven days of each month does the thermometer rise above 82°. The hottest months are from December to March, when the Trade is less regular, and occasional westerly and northerly winds occur. Then the thermometer rises above 82° in eighteen or twenty days of each month, the usual daily maximum temperature being from 83° to 85°, and the minimum between 76° and 77°. The other months of the spring and autumn are of course, as regards their temperature, intermediate in character. The greatest temperature for the year is usually 88° or 89°, a height which is only reached on two or three occasions, and often the whole year passes without a register of 90° being recorded. During the twelve months, the minimum temperature rarely falls below 70°, except in three or four nights. Every few years, however, there is an occasional colder spell, when the daily temperature for a week or two ranges between 65° and 70°, an effect due to some unusual cause, such, perhaps, as the advance of the Antarctic ice. The annual mean temperature of these islands is about 78°·5.

With regard to *humidity* I should remark that, during the settled Trade weather of the winter months, from May to September, the air is pleasantly dry, there being usually from 6° to 8° difference between the wet and the dry bulbs. During the less settled weather of the opposite season of the year, when these islands are at times affected by the monsoon, the Trade being then interrupted by westerly and northerly winds and by calms, the air is less dry; but it is rarely unpleasantly moist, the wet and dry bulbs in the dampest weather being usually from $2\frac{1}{2}$° to 3° apart.

The rainfall has not been measured, but probably it does not exceed 40 inches in the year. From April to September it occurs more as passing showers, which often take place in the night. During the other part of the year it is heavier and more frequent. It would seem that the total number of days on which rain falls is not in excess of one hundred. The rainfall gives a lasting supply of water to the wells, and is sufficient to temper the climate without rendering it uncomfortably wet.

I have referred above to the Trade as from the south-east. It must, however, be understood that, though usually from this quarter, the Trade may vary in this latitude from east-by-south to south. I am, however, correct in saying that the regular wind, usually spoken of as the South-east Trade, prevails for 300 days out of the year. During the winter

[1] My observations were made on the Settlement Island, which, for reasons given below, probably possesses a rather more equable climate than the weather islands.

months it blows very fresh, especially in June, July, and August. Between November and February the Trade is less steady, and, as above mentioned, is interrupted by calms and by variable westerly and northerly winds.

The climate of these islands compares very favourably with that of Levuka, in Fiji,[1] notwithstanding that the latter locality lies nearly 6° farther south, and is situated on the weather or healthy side of the group. Compared with Levuka, the Cocos-Keeling Islands have about the same annual mean temperature, and much the same percentage of humidity; but the daily variation and the annual range of temperature are much smaller. Thus, in Levuka the daily variation amounts to 10° or 11°, and the annual range to about 27° (65°-92°); whilst in the Cocos-Keeling Islands the daily change is only about 7°, and the annual range covers scarcely 20° (70°-89°). Then, again, in the islands I am at present describing, the Trade blows more steadily throughout the year than at Levuka; there is no such marked distinction between the wet and hot and the dry and cool seasons as in Fiji; and the rainfall is probably not much more than a third.

It is singular how the variation in the temperature of the waters at the margin of the lagoon, a subject to which I shall subsequently allude, tempers the climate of some of the lee islands. Thus, in the morning, the waters within 1½ miles of the lagoon-margin have a temperature 7° or 8° lower than they have in the afternoon. In the later part of the day, impelled by the prevailing trade-wind, these warm waters are piled up against the islands in the northern part of the atoll, and in the evening are from *four to six degrees warmer than the temperature of the air.* The result of this is that the climate of Settlement Island, and also of Direction and Horsburgh Islands, is considerably equalised, the cooler temperature of the night hours being raised by the adjacent warm lagoon waters, and the morning heat being lessened by the cooler temperature of the lagoon.

Should it ever be the intention to establish a sanitarium on these islands, the cost of living will be found to be very cheap. Probably an invalid's total expenses, including that of his house, would fall short of £100 per annum. Fish and poultry are at present the staple articles of animal food, the former being very excellent, and in great variety. Rice supplements all the meals. The attire best suited for this cool tropical climate should be made of light grey flannel; and I would also suggest that, since the life at the best would not be characterised by the usual rounds of social life, the visitor should be able to appreciate the natural wonders of this coral atoll.

STRANDED PUMICE—A LARGE VOLCANIC BOMB—FLOATING CORALS.

Stranded Pumice.—I shall refer more than once in these papers to the part which the pumice derived from the great Krakatoa eruption of 1883 has taken in reclaiming land from the lagoon. Narrow inlets

[1] Horne's *Year in Fiji.*

have been obliterated, and the shallow water around the lagoon has been in places filled up by the fields of floating pumice that drifted inside the reefs. The Krakatoa pumice, readily known by its white and fresh appearance, and its unsodden texture, is to be found at present in great quantity on the beaches. It is often still to be observed in scattered fragments on the sea to the eastward, and every day there is some accession to the pumice drift already stranded. Only recently a large mass, nearly two feet across and covered with short-stalked cirripedes (barnacles), was drifted into the lagoon. The fragments of the Krakatoa pumice, as they are found on the beaches, are more or less rounded, and usually vary in size from a pea to a coco-nut. As bearing on the continual arrival of this pumice at the Cocos-Keeling Islands, I should observe that, in August and October 1888, I noticed a large quantity floating in scattered pieces in the Sunda Straits. A considerable amount of fine pumice also came up in my tow-net from the surface in that locality. Evidently a large amount of this material, at present found floating in the Straits, is washed off daily from the shores of Krakatoa.

The Krakatoa pumice is confined to the present beaches; but there is another kind of this material, apparently elsewhere derived, though of somewhat similar composition, which is found inside the raised weather margins of the islands, and extends for some 20 paces or more amongst the trees. It is of much greater age; and whilst its outer surface is darkened by weathering, its interior is often sodden and half-rotten. There is also a black and heavier pumice, formed from a more basic lava, which is known (rightly or wrongly) amongst the residents as the Tomboro pumice, and is found amidst the vegetation 15-20 paces in from the weather beaches. It varies in size from a walnut to a coco-nut; and, unlike the two felspathic kinds of pumice above referred to, it withstands decay, so that although it has been known in the island for half a century and more, its internal substance is still unaltered. Pieces of the older pumice are occasionally found amongst the recent Krakatoa pumice on the beaches; but they have probably, in most cases, been washed off from the shore of some other of these islands.

In a chapter on Pumice in my small work on the Geology of the Solomon Islands, I have pointed out the part that this stranded material takes in the preparation of the soil of a coral island. This process is repeated amongst the atolls of the Indian Ocean; and here, in fact, the recent eruption of Krakatoa enables us to form a more comprehensive idea of the extent and character of this fertilising agency. Wherever, in these islands, a layer of old pumice overlies the sandy soil near the beach, an abundance of volcanic minerals, especially magnetite, occurs in the soil. By means of a magnet, a number of fine particles of magnetite can be collected from a saucer filled with the white calcareous sand that is found between the tide-marks upon the beaches. These particles are angular and irregular in shape; are sometimes coated red by oxidation; and vary in size from $\frac{1}{200}$ to $\frac{3}{100}$ of an inch, the mean usually being about $\frac{2}{100}$ of an inch, or about half a millimètre. Some of these grains are attached to small felspar crystals, which have a partially fused appearance; but such compound grains do not much exceed the maximum size

given above. As we might have expected, the drift sand that has been piled up through the agency of the wind on the coasts of some of these islands contains but little magnetite, the few particles that occur being relatively very minute.

It will, perhaps, be safer for me to leave to others to determine the source of these grains of magnetite with their occasionally attached semi-fused felspar crystals, which are of common occurrence amongst the beach sand of the Cocos-Keeling Islands. The local evidence would seem to show that they are derived from the decay of the pumice that is stranded in such large quantities on these beaches, especially since I found them in greatest abundance in the sandy soil underlying an old bed of pumice. Their large mean size, viz., half a millimètre, and the specific gravity of the mineral, would seem to favour this opinion. It should, however, be noted that during the night following the great eruption in the Sunda Straits, some 700 miles away, fine pumice dust fell over the Cocos-Keeling Islands in such quantity that on the succeeding morning it was found covering the deck of a schooner, that lay at anchor in the lagoon, with a layer a quarter of an inch deep.

That the pumice drift on these coral islands, as on those of the Pacific, is not phenomenal, is shown by the circumstance that Mr. Keating observed "large quantities" on all the islands in 1829.[1] In truth, these ocean waifs form a constant feature of the coral reefs in the Indian and Pacific Oceans.

A huge Volcanic Bomb in Horsburgh Island.—Near the middle of the breadth of Horsburgh Island, and about 300 yards from the sea, there was, when these islands were first occupied, some sixty years and more ago, a huge volcanic bomb about four feet in height. It was somewhat dome-topped, and was imbedded about six inches in the soil. By the islanders this large mass of foreign rock, with its unknown history, was regarded with much mystery. It lay concealed in the midst of an iron-wood forest of great antiquity, where it must have lain for ages; and its burnt-up appearance seemed to support the prevailing opinion that it was some meteoric stone, lying where it fell during those unrecorded centuries that preceded the occupation of the atoll. In more recent years, curiosity, perhaps assisted by superstition, led to the demolition of this so-called thunderbolt. Pieces have been taken away by the inhabitants at various times and for different reasons, the result of this practice being that at the time of my visit in 1888 only a few fragments, none much more than a foot in size, remained to illustrate the description given to me by Mr. Ross. They were, however, sufficient to disclose to me that this mysterious stone was a huge volcanic bomb of a dark reddish cellular lava, possessing a comparatively solid outer crust. The cellular fragments floated buoyantly on the sea; but the more solid parts of the outer crust, on which I also experimented, sank. Nevertheless, as the greater part of the original mass, according to the description given

[1] Holman's *Voyage round the World*, 1835, vol. iv. The voyage and travels of this blind traveller are still well worthy of perusal, notwithstanding that half a century has since passed. His affliction was patiently borne, and his example should not be forgotten.

to me, was evidently cellular, I had no doubt in forming the opinion that the whole bomb originally floated.

Although, however, these facts proved very clearly that the volcanic bomb was but an ocean waif, still it was not so easy to explain its position near the middle of the island, some 300 yards from the sea, where it was originally found hidden in a forest of ironwood (*Cordia subcordata*). It may, of course, have been transported there in past ages by some cyclonic wave that swept it inland from the beach. This occurrence, however, would have probably preceded the existence of the ironwood trees, which are so slow in growth that a tree of twenty years' planting is scarcely more than a sapling. Such a forest must have been of great antiquity; yet the age of the bomb on this reasoning would be far greater. I am myself more inclined to the opinion that the volcanic bomb marked by its situation the former extension of the present lagoonlet, when it was open to the northward and possessed a far greater size. Judging from the localities where the ironwood still flourishes in these islands, viz., on and near the margins of the lagoons and lagoonlets, it would seem most probable that the volcanic bomb was originally drifted through the mouth of this lagoonlet of Horsburgh Island, and that in the course of time it was stranded amongst the overarching ironwood trees that bordered the water. As the lagoonlet decreased in size and depth, young trees soon occupied the mud-flats left by the receding waters. Hence, when the lagoonlet was finally closed, the vegetation gradually occupied most of its area, and thus left the bomb apparently in the middle of the island.

Floating Corals.—If it has seemed incredible to some of the readers of this Magazine that a large volcanic bomb could be transported through the agency of the winds and currents to a coral island in mid-ocean, they will find it yet more difficult to believe that large blocks of massive corals, depending only on their own buoyancy, have been drifted in a similar manner across the sea to the Cocos-Keeling Islands, and that they are even now floating on the surface of the Indian Ocean. The stranding of these coral waifs on coral islands seems very much like carrying coals to Newcastle; yet such is undoubtedly the case.

My attention was first directed to this subject by my finding amongst the vegetable drift on the weather beach of South Island, at high-tide mark, a dead fragment of a species of *Pterogyra*, to which were attached a number of short-stalked cirripedes (barnacles) not yet dead. On throwing it in the water I found that it floated buoyantly, and at once perceived that it had been stranded at the last high-tide after floating for a long period on the open sea. It weighed then 1½ lbs. Mr. Ross subsequently informed me that not infrequently large blocks of corals, mostly of the massive astræan type, and foreign to the atoll, are washed ashore, covered with barnacles, on the weather coasts of the eastern islands. He showed me one in his possession, a massive astræan coral, which was six feet in circumference and weighed 88 lbs.; and in order to convince me of its buoyancy he had it carried to the beach and thrown into the water, when it floated readily. A short time after this I noticed a similar block, stranded on the sandy shore of the lagoon,

which floated easily when I pushed it into the deeper water. It was rather larger, measured seven feet round, and probably did not weigh much under a hundredweight. Mrs. Ross gave me a smaller fragment of another astræan coral, about 2 lbs. in weight, which had been picked up on one of the beaches. I found that it floated buoyantly both in fresh and salt water. This specimen is now in the possession of Mr. John Murray.

Blocks even larger than the biggest of those above referred to are washed ashore at times on the eastern or weather beaches of this atoll, the living cirripedes or barnacles attached to them affording satisfactory evidence of their character as ocean waifs. I need scarcely say that all these floating corals are dead, and that most of them are ancient-looking. All of them are large-celled species, and it is evident that they owe their buoyancy to the closure of the innermost cells, as successive layers of new cells are added to the outer surface of the mass. Such floating coral blocks are to be seen in the Java seas, and, probably enough, after they were originally detached by the breakers and were washed high and dry on a beach, they underwent a lengthened process of drying before another huge roller swept them off oceanward again. The great sea-wave produced by the eruption of Krakatoa in the Sunda Straits in all likelihood carried not a few of such light coral blocks off the beaches, on which they had long been stranded, into the sea beyond. Numbers of such masses must now lie in the depths of the ocean, a circumstance that is at once suggestive of the past to the geologist and instructive also at the present time to the student of the deep-sea deposits.

But there is another means by which smaller masses of shallow-water or reef corals may be distributed over the floor of the ocean. It is already well known that corals can attach themselves to, and grow rapidly on, a ship's bottom. It has, however, also come under my observation that they can grow on floating pumice and on drifting timber, both of which, in the course of time, the one sodden and the other water-logged, sink to the bottom. Washed up on the weather coast of North Keeling Island I found a piece of Krakatoa pumice, on which had grown four bosses of a pretty incrusting species of *Pocillopora*, each of the size of a dollar, and $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness. This piece of pumice still floated buoyantly, and had evidently been caught in the reef for some time before it had been thrown up on the beach. Mrs. Ross showed me specimens about three times the size of the same species of *Pocillopora*, that had grown on a large log of timber, which, having been caught in the outer edge of the reef for about a fortnight, had then been rolled on shore. I have a specimen with the wood still attached. Nearly always the same kind of coral, so I was informed, is found on these floating timbers. Apparently this coral, which grows rapidly, thrives in the wash of the breakers.

North Keeling Island.—This small and little-known coral atoll is in the possession of Mr. G. C. Ross of the adjacent Cocos-Keeling Islands. It lies between 14 and 15 miles to the northward of the islands just mentioned; and since it is connected with them by a

NORTH KEELING ISLAND (ADMIRALTY CHART).

Thickly covered with Coco-nut trees and other vegetation.

With the exception of one or two pits about seven feet deep, the lagoon is less than a fathom deep at ordinary low tide, the greater part, in fact, being covered by less than half a fathom of water. The parallel lines indicate the situations of old passages.

This Plan was made by Captain Fitzroy in 1836. The in-curving arms of the lagoon-opening have since been added, and I have indicated the shoals prolonging them.

The bank, on which anchorage can be obtained, has been extending in recent years; and I have shifted the twenty-fathom line. Vessels can only anchor here during settled Trade weather. They must be prepared to weigh at once if the wind shifts to the northward. Landin is often dangerous, especially during the monsoon season, when it is at times impracticable. Careful steering is required to avoid the numerous patches of old reef that front the landing-place.—(H. B. G.)

submarine bank, the greatest depth over which is said not to exceed 100 fathoms, it should be considered as geographically included in the same Cocos-Keeling group. It did not fall to the lot of either Darwin in 1836, or of Forbes in 1878, to land on its shores; and in all the descriptions of this group that I have perused, the references to this small atoll are scanty in the extreme. On a later page I have referred to the sketch of this island made in 1749 by Captain Ekeberg, a Swede, and I have there given his notes. (The plan will be found accompanying this paper.) No landing, however, was then effected. In 1836 Captain Fitzroy, R.N., made another more complete plan showing the interior lagoon. This is also reproduced here with a few additions.

The chief points of interest in this island are to be found in the circumstance that it exhibits some novel and instructive features in its growth as an atoll, and also in the fact that since it has been less affected by human occupation than the islands of the neighbouring larger atoll, we can form some idea of the original flora of the group before it was finally occupied by man in the early part of the present century. The subject of the flora, however, will be dealt with in a later paper, when I shall describe it with especial reference to the dispersal of plants.

When we approached this island on August 18th, 1888, numerous frigate-birds and boobies came off to greet us, and we observed that the trees near the coast were dotted with these birds. We dropped our anchor at the only spot where a vessel can lie, off the west coast of the island; but in the best of weather it is an uncertain holding-ground, and if the wind shifts round to the northward at all, the vessel has to weigh immediately and leave the party on shore to their own devices. Scores of anchors have been lost here, and weeks have elapsed before the party could be taken off. The landing also is often impossible, and even with the most favourable conditions it is not altogether free from danger, unless local knowledge is possessed. When I landed with Mr. Ross we first visited the buildings to ascertain that nothing had been tampered with during the thirteen months that had elapsed since the previous visit. The proprietor, who has often rendered generous assistance to the crews of vessels shipwrecked in his group, keeps on this island a boat for the use of castaways. At one time it was his habit to keep here a store of provisions for their benefit; but the criminal escapade of a Norwegian skipper in 1881 led him to abandon this plan. It seems that in that year the master of a Norwegian ship landed and took away with him a skiff, together with provisions and other articles. On arrival in Norway, one of his crew informed against him, when an inquiry was held, and he was, I believe, punished. I should here remark that any castaways on this island would always find a plentiful supply of poultry, coco-nuts, and papaw fruits; but that any attempt of passing ships to help themselves would probably not escape the notice of those living in the neighbouring islands.

We spent six days on the island, living very comfortably on sea-birds and fish, supplemented by rice and biscuits. Our dinners were truly of a novel character, consisting generally of stewed frigate-birds, curried boobies, and other sea-birds, fish freshly caught in the lagoon, the flesh of the coco-nut crab (*Birgus latro*) torn into shreds and fried; and

as vegetables, we had the papaw fruit, which, when boiled in the green state, is a very good substitute for vegetable marrow; whilst coco-nut palm tops, nicely cooked, reminded us of tender cabbage. With our coffee we ate rice-biscuits, which were merely the rice-grains that had adhered to the inside of the pot after the boiled rice had been emptied out, the pot being afterwards placed again on the fire until a crisp kind of biscuit incrusted its sides. If Mrs. Ross had been present, I could have written a chapter on her different modes of cookery, as she has a thousand and one ways of adapting to her use the seemingly scanty produce of these islands. I had many subsequent opportunities of wondering at her skill, and tried in vain to persuade her to give the outside world the benefit of her knowledge. However, I would suggest that one of her daughters should copy her mother's recipes surreptitiously, and send them to the editor of the *Queen* newspaper.

Notwithstanding its occasional occupation, this small atoll is still the home of great numbers of frigate-birds, boobies, gannets, noddies, etc. The gannets build their nests on the ground on the weather coasts; whilst the frigate-birds and the boobies mostly frequent the north and south shores of the lagoon, where they almost cover the bushes of *Pemphis acidula* that border the water. So tame were the frigate-birds and the boobies, that we could catch hold of them as they sat on their nests on the bushes, and knock them down with a stick as they came around us. These proceedings did not seem in any way to discompose their neighbours, who sat unobservantly two feet away, and displayed no concern in the matter. After a day or two, however, the birds got more shy; and then it was curious to observe that the first to fly was the bird that had neither an egg nor a young one to protect; the next to fly was the bird over its egg; and the last to go left a featherless young one to our mercy. The nests are constructed of the twigs and light branches of the Pemphis bushes, and never, as far as I saw, contained more than a single egg. The prettiest of the sea-birds in North Keeling Island are the snow-white terns (*Gygis candida*), so well described by Darwin and Forbes.[1] They fluttered and hovered in pairs close over our heads, as if anxious to inquire our meaning in disturbing them. Mr. Ross especially endeavours to preserve these little birds, for they are the tiny pilots of these seas, and are often the means of checking a vessel from running past the islands. He has also been attempting to prevent, or at any rate to postpone, the extinction of all the sea-birds on the island. Half a century ago they were equally as numerous on the Cocos-Keeling Islands; but the islanders, who greatly prize their flesh, have driven them entirely away; and in spite of the vigilance of Mr. Ross, it is evident, as I am told, that through the clandestine visits of his people, their numbers are annually decreasing on North Keeling Island. During the time of the grandfather of the present proprietor, the birds on North Keeling Island are said to have numbered myriads where they now can only be counted in thousands. However, I may remark that they are yet to be seen in considerable numbers.

[1] This bird deposits its solitary egg on the bare leaf of a young coco-nut palm in such a manner that it is difficult to understand how it can retain its position when the leaves are waving in the wind (*vide* Forbes's *Eastern Archipelago*, p. 33).

Although there is no collection of guano proper on the island, owing to its surface being thickly vegetated, the droppings of the great numbers of birds that have resorted here for ages have fertilised the soil to such an extent that it forms an excellent manure. So productive is the soil itself that the vegetation is much more luxuriant and rapid in its growth than in the adjacent islands; and fruits, such as those of the papaw-tree, become unusually large and numerous. It would appear that all over the island the soil and surface-stones have become impregnated with guano-salts to a greater or less extent. In two pits that were dug to a depth of a couple of feet, in different localities, there was about a foot of dark soil overlying a light-coloured limy earth. I found that the dark soil, which probably also contains ammonia, possessed from 30 to 35 per cent. of phosphates; whilst the light earth beneath, which contained a good deal of carbonate of lime, proved to possess from 20 to 25 per cent. of phosphates. Scattered about on the surface and in the soil are numbers of reddish-brown friable nodules, still exhibiting the coral structure, which contained as much as 60-70 per cent. of phosphates; and the outer portions of many of the larger coral stones are formed of this reddish-brown friable high-percentage material. It is evidently through the agency of rain that the soil and the coral stones have become more or less soaked with the guano-salts; and it should be noticed that this effect is dependent on an unfailing supply of bird-droppings; for in the neighbouring Cocos-Keeling Islands, which the birds have deserted during the last half-century, I found only a trace of phosphates, as I shall subsequently remark, and the friable reddish-brown nodules have long since been broken down. Here, in fact, the rains have washed the guano-salts away, there being no longer a supply of bird-droppings.

It is probably owing to the presence of guano-salts in the soil and in the ground beneath that a well sunk in North Keeling Island has recently attracted some notice as supplying a mineral water which is a reputed cure for "beri-beri." Otherwise, I am at a loss to explain why the well-water of all coral islands should not possess similar curative qualities. When we reflect that often the water from a well sunk in such islands is a little brackish, one would be inclined to consider, judging also from the analysis given below, that this mineral water, so called, is merely brackish water that has obtained its additional characters and its reputed medicinal qualities by permeating a ground into which the rain has carried guano-salts. Since it is important that a remedy of this kind should be properly inquired into, I append the description and analysis of Mr. W. S. E. Hekmeyer, Chief of the Chemical Laboratory of Batavia, for which I am indebted to Mr. G. C. Ross. The Dutch Government at Batavia have lately given an order for a number of samples of this water from North Keeling Island; and I trust that it may be found of service in checking the ravages of "beri-beri" amongst the troops of Netherland India. In that event, if my opinion of the true character of this water is correct, a cure for "beri-beri" will be found in many other coral islands where sea-birds congregate.

Analysis of North Keeling Water.

Description.—"Clear; somewhat yellowish; taste faintly bitter, and a little saltish; no smell; on boiling, a precipitate of lime carbonate; spec. grav. 1·0034

at 27·5° C. On analysis the water contains potash, soda, lime, magnesia, carbonic, sulphuric, and hydrochloric acids; also traces of nitrous and phosphoric acids, alumina, silica, iron, and bromine."

Carbonate of Lime, ...	0·336 grammes.
Sulphate „	0·435 „
Chloride of Calcium, ...	0·138 „
„ Magnesium.	0·488 „
„ Natron, ...	2·840 „
„ Kalium, ...	0·236 „
Phosphoric acid, bromine, silica, iron oxide, ammonia, alumina, ...	Traces.
	4·473 grammes per lit.

It will be an interesting study for the naturalist who next visits the Cocos-Keeling group to make a complete collection of the insect fauna of North Keeling Island and of the islands of the large Cocos-Keeling atoll for the purposes of comparison. I doubt, however, whether any very important difference will be found, since there has been such free communication between the two atolls during the last half-century that the distinction which once existed is probably in great part lost. The introduction of numbers of new insects from Java and elsewhere since the visit of Mr. Darwin in 1836 has been dwelt upon by Mr. Forbes;[1] and for my own part, I must confess that, being more especially interested in these islands, not only by reason of their characters as coral atolls, but also from the important light which my examination of their original flora threw upon the subject of the dispersal of plants by natural agencies, I felt little tempted to inquire into the disturbing influences of man.

Viewed as an atoll, North Keeling Island, which is rather over a mile in length, encloses a shallow lagoon that has a single opening leading into it on its east or *weather* side, a very unusual circumstance with this class of coral reefs. This opening, however, across which the surf is always breaking, is not a break in the reef, but is merely a gap in the otherwise continuous land-margin, and neither ship nor boat can enter the lagoon (see Plan). The width of the belt of land is generally between 300 and 350 yards, and the usual height is 10 to 12 feet—never, as far as I could perceive, exceeding 15 feet. The reef-flat invests the outer border of the island, except, as shown in the map, on the west and north-west sides, which are the sheltered or lee sides during the greater part of the year, and here there is but little living coral; there are, however, the remains here of an ancient reef-flat, now being gradually broken up by the sea, from which, during cyclones, huge fragments are occasionally torn off and washed upon the beach. Near the landing-place on the beach there is one such huge mass of *Porites*, which, judging from its measurement, cannot weigh less than twenty-five tons. It is partly covered with sand, and is washed at high tide. I was informed that it has been in its present position as long as the residents can remember.

An examination of the reef-flat skirting the island, especially on the weather, southern and eastern coasts, discloses to the observer the inter-

[1] *Eastern Archipelago*, p. 31.

esting circumstance that it has grown seaward by a series of "jumps" rather than by a continuous outward extension. This mode of growth has long been a subject of observation with Mr. Ross both in this atoll as well as in the Cocos-Keeling Islands, and I shall have further occasion to refer to it in detail. Here I may briefly say that the successive steps in the outward growth in the reef are indicated by the parallel lines of old reef-margins that protrude above the flat.

The lagoon is very shallow, by far the greater part of it at ordinary low tide being less than 3 feet deep, with depths here and there of from 4 to 5 feet, and one or two pits where my soundings showed 7 or 8 feet. The passage leading into the lagoon, or rather the break in the land-margin, since there is no gap in the reef, has a depth at ordinary low tide varying between 3 feet just within the breakers to 1½ feet further inside. At spring low tides, however, the sand-flats lining either side of this pseudo-passage are exposed to such an extent that they almost fill it up, leaving only a narrow channel, 1 to 1½ feet deep. It may be generally stated that corals do not at present grow in this lagoon, the bottom being of fine sand and mud, mostly covered with turtle-grass. Here and there a dead coral mass may be seen in the southern part, but the conditions for coral growth are most unfavourable, except of course at the seaward mouth of the passage leading into it. The most unfavourable repressive agency appears to exist in the circumstance that large quantities of sand and mud are carried through the passage into the lagoon, the product of the incessant action of the breakers. Then again, though there is a small counter-current running out through the passage, it is not of sufficient extent to keep the waters of the lagoon wholesome, and suited for coral growth. That they do not circulate freely is shown in the fact that, whilst the temperature of the sea in the wash of the breakers was 83°, I found the water in the lagoon to be 86½° where it was a foot deep, and 85½° where it was 2 feet deep. This observation was made soon after mid-day, the temperature in the shade at the time being 82½°.

Though it is evident enough from the facts to be given below that the lagoon has been filling up in recent times, the early references to it appear to offer testimony at conflict with this assertion. However, as a matter of fact, these references were often second-hand, and do not accord with the recollections of the present proprietor and his people. Mr. Keating, writing of its condition in 1829, speaks of the "tide overflowing its centre at high water, so as to give it the appearance of a basin."[1] His brief mention of the island, however, does not suggest a personal acquaintance with it. Deriving his information from Mr. Leisk in 1836, Mr. Darwin speaks in his journal of the lagoon being "nearly filled up with coral mud," and in his work on Coral Reefs, of its being "dry at low water." Captain Fitzroy, who surveyed the island, refers to it as "a strip of low coral land almost surrounding a small lagoon."[1] It would appear probable, however, that his plan of the island, which does not enlighten us further on the subject, was made from a running survey, and that his information of the interior was derived from Mr. Leisk. He makes no reference to any landing being effected on the island. . . .

[1] Holman's *Voyage*, vol. iv.

For my own part, I should add that within the memory of the present proprietor of the island, recollections that go back some thirty years and more, the lagoon has never been in the condition of a basin dry at low water.

That all the changes observed during the past thirty years are tending to fill up the lagoon, there is abundant evidence to show, notwithstanding that the testimony of earlier years is somewhat conflicting. The curving in of the margins of the passage leading into it is a very curious feature in this obliteration of the basin, and one not indicated in the *Beagle's* early plan; and the curve is continued or prolonged by sand-banks or shoals, giving the whole land-margin of the atoll the outline of a double scroll. These in-curving arms were originally sand-banks that have since become clothed with vegetation. They have extended considerably into the lagoon in recent years, *pari passu* with the extension inwards of the sand-banks that prolong them. During the last quarter of a century the increase has been especially noticed in the instance of the northern arm, and young trees and shrubs now grow where not long since there was a sand-bank covered at high tide. Mr. Ross also follows up this process by planting coco-nut palms on the newly formed land.

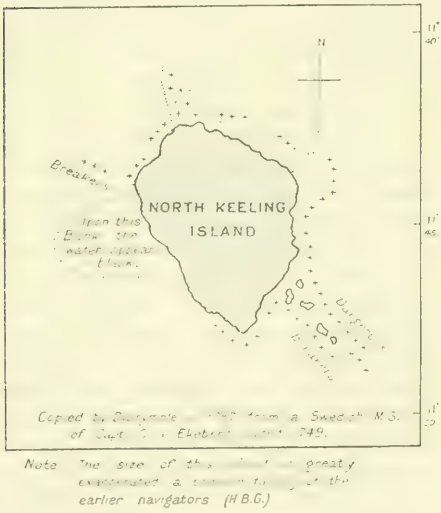
Very noticeable changes also have taken place in the lagoon, particularly since the Krakatoa eruption in 1883, when large quantities of pumice were collected and pent up in its interior. Since that date its shores, especially in its northern part, have in many places advanced from twenty to thirty yards, and young trees, such as *Cordia subcordata*, together with young coco-nut palms, now grow where the waters stood then. The pumice was heaped up in the shallow water, and there the sea-weeds common on the lagoon shores caught and collected, and, decaying rapidly, soon formed a suitable ground for the growth of *Sesuvium Portulacastrum* that usually covers the shore flats. A coarse grass subsequently clothed the new surface, and the neighbouring vegetation began to occupy the new land. One could perceive this process in all its stages. In some parts the bare flats exposed at low water were composed entirely of fine pumice six inches deep. In another place the pumice was more or less covered with the weed, whilst near by the last stage would be exhibited; and in such newly formed ground, which the vegetation was beginning to occupy, my stick sank readily half-a-foot deep into nothing but decayed weed and rotting pumice.

It will be wiser if I defer the explanation of the origin of this small atoll until after the description of the large Cocos-Keeling atoll. The key to its peculiar history is there to be found, and it is to the past acute observations of its proprietor that I am largely indebted in this respect. I shall then proceed to consider the agencies now working in these coral islands, and the processes there in actual operation; and it will be perceived that the study of the one atoll throws considerable light on the other.

It should, however, be remarked that North Keeling Island originally consisted of three or more islands, and that the old passages may yet be traced as indicated in the plan. In the early days of Mr. Ross, the old situation of one of these passages through the northern portion was

[1] *Voyages of "Adventure" and "Beagle,"* vol. ii. p. 630.

clearly shown by the narrow width of the land belt, by the young trees, and by the scanty soil, whilst the water cut nearly across the island from the lagoon side. Similarly, about a quarter of a century ago, the southern part of the island was almost separated, except at its seaward or outer margin, the water of the lagoon overflowing most of the original passage. The outer mouth of this passage is still indicated by a partial gap in the reef, and by the extensive exposure of the old reef conglomerate that once bounded its seaward entrance. In the next place, I should refer to another recent alteration of this island. During the past ten or fifteen years the shore opposite the landing-place on the west coast has advanced some fifteen or twenty paces, the old line being indicated by the overhanging coco-nut palms now removed that distance from the sea. It was largely the work of a night, a huge pile of coral blocks being piled upon the beach during a cyclone.



Note. The size of the ... greatly exaggerated ... the earlier navigators (H.B.G.)

Off the west side of the island there exists a sandy shoal, not marked in the Admiralty Plan, which has been extending in recent times to a marked degree, so that the schooner of Mr. Ross cannot now anchor where it did several years ago. This shoal is indicated in the old plan of Captain Ekeberg, made in 1749, and reproduced in 1787 by Dalrymple, the English hydrographer, in his "Plans and Charts." Although the old plan merely represents the coast-line and the outlying dangers, being in fact nothing more than a running sketch on a scale much exaggerated, still it is of some value to those who attach importance to the past condition of a coral island as affording a clew to its origin. This, I say with emphasis, is a line of investigation which was closed by a theory like that of Mr. Darwin, and one which, strange as it may appear to philosophical minds, was until the last quarter of a century but little pursued. In a subsequent paper I shall allude to the conclusions deducible from all the old plans of the Cocos-Keeling group.

Captain Ekeberg's remarks on the island in 1749, extracted from his Swedish journal,[1] and placed in a note in Dalrymple's reproduced plan, are as follows:—" . . . On the E. side of the Island could see no landing-place, being full of Breakers from a Reef stretching towards the S.E., where we saw five Rocks above-water as high as a Ship's Boat, about which were many white Birds and Mews. At the N. End there stretched out a Reef on which the water broke. Within the N.E.-most Breakers

[1] The extract was translated some years afterwards, and, as will be seen, is in the style of the old English navigators.

saw a plain Beach of reddish sand. On the W. side of the Island saw a long flat Bank, on which the water was smooth, with the appearance of good landing. The whole Strand was full of Coco-nut Trees, on which were many nuts. It is unknown if there be other refreshments. The Island was full of Trees. This was the Northmost of the Cocos; it is 5′ or 6′ long. and 3′ or 4′ broad: we saw two other Islands, which lay from this Island; one S. $\frac{1}{4}$ E. 4 or 5 leagues, the other S. b. W. 3 or $3\frac{1}{2}$ leagues; they did not look to be so large as this Island. We soon lost sight of it, and were followed by a Flock of Men of War Birds."

From the comparison of the new and old plans of this island, it will be observed that the five rocks off the southern part are now gone, though memories are still retained of them. The reference to a "plain beach" within the "north-eastmost breakers" evidently applies to the break in the land-margin corresponding to the passage into the lagoon on the east side. The size of the island is of course much exaggerated, and it is strange that there should be no reference to the lagoon. However, when dealing with a still older chart of the whole Cocos-Keeling group, in which the relative position of this island is correctly indicated, I shall have further occasion to refer to this subject.

(To be continued.)

SOUTH AMERICAN RAINFALL SOUTH OF THE TROPICS.

(With a Map.)

By William B. Tripp, M. Inst. C.E., F. R. Met. Society.

The rainfall records of the immense continent of South America are few indeed compared with the vast area over which they are scattered.

Of the interior region of Brazil, who has any exact information extending over a long series of years?

For the most part, a few stations round the coast give all the available information of South American rainfall of the tropical regions.

Of that part, however, lying to the southward of the tropic of Capricorn, and occupied by the southern portion of Bolivia, Paraguay, and Brazil, the northern parts of the Argentine and Chilian republics, and the republic of Uruguay,—a region comprising some of the most fertile and favoured regions of the globe, and which appears destined to play no unimportant part in future history—there has been published, within the last dozen years or so, much interesting information.

The Cordoba Observatory has issued six splendid volumes of Meteorological Annals, under the administration of its successive Directors; and although it must even now be said that the information published is far from being so complete as might be desired, still it may be hoped that this may be remedied by the publication of subsequent volumes.

Other records found in various publications have also been made use of for the present discussion of the rainfall. From such data the author has attempted to compile a map of the mean annual rainfall, showing approximately, so far as is at present known, curves dividing the area into rainless portions, and also those having from 0 to 10, 10 to 20, 20 to 30, 30 to 40, 40 to 50, and over 50 per cent. mean annual rainfall respectively.

One of the first points likely to strike an observer is, the extreme difference in the amount of annual rainfall between places very near to each other, particularly in the neighbourhood of the Sierras.

Dr. Gould, late Director of the Cordoba Observatory, speaking of this characteristic, says : " While Villa Formosa, the new capital of the Grand Chaco, has a mean fall during over three years of nearly 73 inches, in San Juan, the average of over six years is hardly 3 inches, and there are parts of the eastern slopes of the Andes, as well as of the Llanos of Rioja, where rain is almost unknown. At the Chilian stations of Cerral and Valdivia the fall is over 100 inches, at the same time that at Copiapo, in the period of four years, over which the meteorological observations extend, there was only a total of about $1\frac{1}{4}$ inches, or an average of nearly $\frac{1}{3}$ of an inch per annum, and nine years has been known to pass without any rain."

Dr. Gould questions whether this extreme diversity in places so near together is equalled in any other part of the world.

The rainfall in the part of the world now under consideration presents several characteristics very similar to those exhibited in that of those parts of the Cape of Good Hope which occupy respectively similar latitudes.

Like the Cape of Good Hope, the opposite coasts of South America are exposed to different rain-producing winds, the monthly falls in different parts attaining their maxima at different seasons of the year, as may be seen from the diagrams of monthly rainfall accompanying this article.

The principal rainfall also along the opposite coasts culminates in different latitudes, while in the extreme north-western region there is in both cases an almost rainless area. Unfortunately, the African continent is not continued in a southerly direction far enough to enable the comparison to be extended further to the southward. There is, however, as has been pointed out elsewhere, a difference in the physical features of the two continents, causing a relative distribution of the rainfall to ensue, very much to the advantage of the South American continent, inasmuch as while the lofty mountain range of the Andes, lying on its western side, causes the south-easters to gradually drop their moisture over the extensive intervening area gently sloping down from them to the east coast, in South Africa, unfortunately, the mountain range lying near to the east coast, in the latitudes in which the Trades are, the rain-bearing winds exhaust their moisture within a comparatively small distance from the coast, leaving a very large portion of the country situated at the back of the mountains with a very deficient rainfall. There is, moreover, a fortunate similarity between the two continents,

inasmuch as the geological formation, both of South Africa and South America, yield mineral treasures to a vast extent.

It is impossible to exaggerate the importance of the conditions of annual rainfall as bearing upon the relative prosperity of countries situated in such latitudes as these. In this part of South America the longest records have been kept at and near Buenos Ayres and at Bahia Blanca, and the author has given a diagram of the annual falls in chronological order, as exhibited by the combined records of Buenos Ayres and the Estancia San Juan in its vicinity, and that at Bahia Blanca.

This diagram appears to prove a steadily increasing annual rainfall to have taken place for some years past; and this is a very different result from that exhibited in other southern continents, and the explanation of the phenomenon would be interesting.

At any rate, the author has heard it said that previous to the disastrous epidemics which occurred towards the close of the decade 1860-70 there were several years during which "dry pamperos" were experienced. For many years past, however, the trade and prosperity of the Argentine Republic has advanced in a remarkable degree, and this more particularly in recent years—a result very probably owing in a great degree to the abundant rainfall which has also taken place, every drop of which means more produce exported, and more gold imported in exchange.

It appears probable, however, judging from past records in various parts of the world, that a gradual increase of rainfall for some years is likely to be followed by a corresponding gradual decrease, and it is to be hoped that the Argentine Republic will not forget to improve its present period of prosperity, by husbanding and developing its resources, not only by the construction of railways, but by inaugurating well-considered works for storage of water and irrigation, not only to provide present traffic in produce for the railways, but to prepare for a period during which less favourable conditions of rainfall may prevail.

The east coast of South Brazil, Uruguay, and the northern portion of the Argentine Republic, are exposed to the south-east trade winds, and the rainfall attains its maximum in the spring and summer months. This occurs particularly in the sub-tropical inland regions.

As higher latitudes are reached, the fall becomes more equably distributed throughout the year, and the amount decreases from over 60 inches at Uberaba to probably some 10 inches or less in parts of Patagonia.

In those parts of the Argentine Republic lying between Chubut, where the fall, so far as hitherto recorded, appears to be under 20 inches, and the few rainfall stations round Cape Horn and the Falkland Islands, where the fall appears to be over 20 inches, there appear to be no complete records of rainfall existing; there seems, however, to be every probability that the annual fall dwindles to very small proportions in some of these regions.

The west coast has its principal fall in the latitudes of the Anti-trades. For some 6° or 7° to the south of about 37° south latitude an extremely heavy rainfall occurs in the winter months, brought by winds from the north-west, the amount reaching, as was stated above, to an annual fall

of, in some cases, over 100 inches, some 24 or 25 inches of which occur in the month of July.

This is all precipitated within a short distance of the coast, against the steep declivities of the Andes, leaving nothing but dry rainless winds to descend the other side on to the arid plains of Patagonia.

The same thing occurs in an opposite direction in the north-western rainless region of which mention has previously been made.

The moisture being entirely condensed from the South-east Trades on the eastern slopes during their passage over the Andes, these winds as they descend the opposite sides have acquired the extremely dry character which is so well known, as being characteristic of Peru, and part of Bolivia, and which has produced such remarkable and well-known local phenomena.

The condition of winds and currents along the north-west coast are utterly unfavourable to any rainfall coming from the sea.

In Patagonia, on the other hand, the meteorological conditions along the south-east coast appears to be more favourable for producing some degree of rain. There appear, however, to be every probability that the south-western coast has a much more abundant rainfall than the south-eastern, even to the southward of the heavy rainfall districts of Chili above referred to. It also appears very probable that lying between the eastern and western coasts of Patagonia there is a dry belt getting much rain from neither side.

The author resided for some years in Buenos Ayres, and has given an account in the *Quarterly Journal of the Meteorological Society*, 1879, of the Pamperos and some of the prevailing winds.

He has compiled from time to time, from various sources, a list of some of the more important falls of rain, which he ventures to think may here be interesting, viz. :—

March 31, 1870.—5″·71 of rain in 4 hours, at Buenos Ayres.
October 11-12, 1874.—4″·75 of rain in 24 hours, at Buenos Ayres.
April 30 to May 2, 1877.—8″·62 in 28 hours, of which about 6″ fell in 13½ hours, at Buenos Ayres.
August 28-31, 1877.—5″·25 in 40 hours, at Monte Video.
December 30-31, 1877.—8″·5 in 24 hours, at Monte Video.
September 23 to October 7, 1884 (exact date not known).—9″ in 24 hours, at Buenos Ayres ; the greatest flood known.

Most of the rainfall comes with the Pamperos ; these may be, however, either wet or dry. Many of the latter are said to have occurred, as already stated, at the period above referred to, previous to the epidemic.

It is to be hoped that improved sanitary conditions may have rendered the occurrence of these epidemics a thing of the past in Buenos Ayres.

With this article is given a table of some of the principal records of annual rainfall, with the period over which the records extend, and the approximate latitude of the locality, references, etc.

TABLE OF SOME OF THE PRINCIPAL RECORDS OF ANNUAL RAINFALL.

Locality, with Approximate Latitude.	Annual Fall. Inches.	Period over which Record extends. Years or Portions of Years.	References.
S. Lat. 10° to 25° .			
Atacama, Bolivia, .	0	...	Contributions to Meteorology, E. Loomis.
Uberaba, Brazil, .	...	3	Symon's Met. Mag.
Nova Friburgo, Brazil,	56	4	Revista Obs., Rio Janeiro.
Rio Janeiro, ,,	48	12	Raulein, Obs. Met. Fr. Septentrionale.
,, ,,	55	4	Bulletin de l'Obs. Imp. de Rio Janeiro.
San Paulo, ,,	59	5	Joyner, Quart. Jour. R. Met. Soc.
Sienna do Cubatao, Brazil, . . .	141	15	Contributions, etc., East Loomis.
Santos, Brazil, . .	99	...	Do. do. do.
25° to 30°.			
Salta, Arg. Repub. .	25	7	Anales de la Officina Met. Argentina.
Villa Occidental, .	72	3	Do. do. do.
Villa Formosa, . .	73	4	Do. do. do.
Tucuman, Arg. Repub.	38	9	Do. do. do.
Copiapo, ...	0·3	4	Do. do. do.
Corrientes, . .	52	8	Do. do. do.
Pilciao, . . .	5	7	Do. do. do.
Santiago del Estero, .	28	7	Do. do. do.
Catamacra, . .	10	3	Do. do. do.
Goya, . . .	45	11	Do. do. do.
Rioja, . . .	12	4	Do. do. do.
Saladillo, . . .	18	5	Do. do. do.
La Serena, . . .	1·5	4	Do. do. do.
30° to 35°.			
Villa Hernandarias, .	38	8	Do. do. do.
Cordoba, ...	27	10	Do. do. do.
Concordia, . .	46	4	Do. do. do.
San Juan, . .	3	7	Do. do. do.
Rio Grande do Sul, .	38	6	Zeitschrift für Meteorologie, 19.
San Joije, Uruguay,	44	5	Jour. Scottish Nat. Society.
Parana, . . .	38	8	Anales de la Officina Met. Argentina.
Fraile Muerto, . .	36	3	Do. do. do.
Mendoza, . . .	8	5	Do. do. do.
Rosario, . . .	46	6	Do. do. do.
Valparaiso, . .	14	4	Do. do. do.
San Luis, . .	22	4	Do. do. do.
Santiago de Chile, .	13	16	Obs. Met. Observatoria de Santiago.
Nueva Palmira, .	27	5	Anales de la Officina Met. Argentina.
San Antonio de Areco,	33	4	Do. do. do.
Tatay, . . .	34	6	Do. do. do.
Buenos Ayres, . .	34	17	Do. do. do.
Estancia San Juan, .	40	20	Do. do. do.
Cape San Antonius, .	32	27	Jour. Scot. Met. Soc.
35° to 40°.			
Monte Video, . .	44	10	Zeitschrift für Meteorologie, 11.
Chaera de Matanzas, .	37	5	Anales de la Officina Met. Argentina.
Falca, . . .	21	3	Do. do. do.
Salado, . . .	30	4	Do. do. do.
Dolores, . . .	33	4	Do. do. do.
Tandil, . . .	38	7	Do. do. do.
Bahia Blanca, . .	22	23	Do. do. do.
Valdivia, . . .	116	19	Zeitschrift für Meteorologie, 1876.
40° to 45°.			
Corral, . . .	108	3	Anales de la Officina Met. Argentina.
Puerto Montt., .	96	10	Zeitschrift für Meteorologie 1876.
Ancud. (Chiloe), .	52	3	Do. do. Anales.
45° to 50°.	No records.		
50° to 55°.			
Port Stanley, . .	20	3	Anales de la Officina Met. Argentina.
Punta Arenas, . .	23	8	Zeitschrift für. Meteorologie, 1876.
Ushuaia, . . .	21	4	Anales de la Officina Met. Argentina.

SCIENTIFIC EARTH-KNOWLEDGE AS AN AID TO COMMERCE.

By Hugh Robert Mill, D.Sc., F.R.S.E.,

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The application of scientific principles and scientific processes to the innumerable departments of industry has increased the economy and utility of every manufacture; and, just as geology is the science of most importance to the miner, chemistry to the soda-ash manufacturer, and engineering to the maker of machinery, so Earth-knowledge, which unites the results of the special sciences, is a study most valuable to the merchant, applying scientific principles and modes of thinking to commerce, which unites all industries and peoples.[1]

Earth-knowledge, or physiography, or physical geography in the wide sense, has to do with the substance, powers, and processes of the world we live on. Geography pictures for us the actual condition of the Earth's surface and the present distribution of natural features. Earth-knowledge explains the origin of the actual features, and by their past changes predicts their future distribution. All human life depends on redistributing the substance and the power of the world, and commerce is simply the process of this redistribution. The accidental surroundings of the process, such as the relations of supply and demand, prices, exchanges, the formation of companies and syndicates, naturally and necessarily require most of the merchant's attention; but the principles of Earth-knowledge underlie the whole, and these will tell in the long-run. All knowledge of the Earth's surface must begin with its configuration and topography—that is, the form and distribution of the heights and hollows, and the natural phenomena immediately connected with them; and a sketch of these conditions must precede the more special part of this paper.

On an orographical map it is noticeable how the features of each continent repeat themselves, and become modified. South America, the simplest and most typical, has its backbone of a lofty mountain ridge in the west, and three great river-systems flowing east and south in valleys that they have worn down into vast flat plains. North America is a flattened, frayed out and enlarged duplicate. Africa in many respects repeats the features of South America, but its coast-line is smooth and harbourless; its high lands are huge plateaus piled on each other in terraces towards the east and south, and its rivers, with two exceptions, are spoilt for navigation by falls near their mouths. Australia resembles South Africa on a reduced but intensified scale, its one great river flowing far towards the dry interior before it turns its reduced waters to the sea. Finally, Eurasia, on account of historical and poli-

[1] See "The Relations between Commerce and Geography," in the *Scottish Geographical Magazine*, vol. iii. p. 626.

tical considerations, is classed as two continents. The vast eastern body of the land, bearing the name of Asia, contains the grandest mountain system of the globe, the Himalayas, walling towards the south the highest plateau and the greatest stretch of elevated land. Its great rivers round the edge of the central heights radiate outward, like the spokes of a wheel, most of them to the frozen Arctic Sea; but towards the centre they run inland and dry up in desert sands which were once covered by vast lakes. The western bunch of peninsulas and islands, Europe, is unique in possessing a greater length of coast-line and a greater number of inlets and rivers suited for harbours than any equal area of the land surface of the planet.

In the four continents which border the Atlantic Ocean and its extension the Arctic Sea, the wide flat valleys of the greatest rivers all dip towards that narrow canal-like depression. The Atlantic, in fact, receives more than half the drainage of the world, and water highways lead inland from it to nearly half the land surface of the globe. Rivers are important as entrances to the land quite as much for the roads and railways that can be made along their valleys as for the navigable waterway they afford. The Indian Ocean and the vast Pacific receive far fewer, and, as a rule, far shorter streams, which flow down narrower, steeper, and less accessible valleys. The arrangement of islands along the margins of continents is remarkable. The British Islands front the Seine, the Rhine, and the Elbe, on the west of Eurasia; the Japanese Islands front the Yang-tse, the Yellow River, and the Amur on the east; each group is distant enough from the continent to be safe from invasion, near enough to be convenient for trade. Great island-groups bridge the gap between the northern and southern members of each of the three pairs of continents, the smallest of these—the Greek islands—produced the springs of modern civilisation; the West Indies and the Eastern Archipelago were for centuries the mainstay of European commerce.

The configuration of those parts of the solid Earth-surface that are concealed beneath the waters of the ocean has recently become of commercial importance in laying telegraph cables; and this, in fact, is the reason we know so much about it. Here Earth-knowledge was aided by commerce, but the safe bed found for submarine telegraph cables amply justified the voyages of discovery.

The masses of land and the expanses of sea which diversify the globe are enveloped by the gaseous atmosphere. The substance of the world is diverse; more than seventy different elements are recognised by chemists, yet by far the most of what can be examined is composed of ten or a dozen of these elements combined by twos or threes. There are two different things, and two only, which scientific men have recognised as composing the Universe; these are matter and energy: one is substance, the other is power, using these words in their literal sense. The substance is all in the world already—although certainly a little meteoric iron, of which sword-blades that used to bring the highest prices were made, reaches us from without. All power, however, comes, or has come, from the Sun, and every movement natural and artificial on our planet is a result of the use of Sun-power either directly

or indirectly. Physical geography describes the parts of the world as a vast machine at rest; physiography or Earth-knowledge describes it as a vast machine in motion.

Solar energy is at work pouring perennial summer on the torrid zone, over some part of which the Sun is always overhead, and the annual warmth falls off gradually to north and south, the winters becoming longer and their days shorter, the summers becoming shorter and their days longer towards the poles. This is why wheat can be grown, where other conditions are suitable, close to the Arctic Circle.

The Sun's heat produces winds and ocean currents, which would flow from the equator towards the poles, with parallel return currents, were the Earth uniform and motionless. But the continents obstruct them, and the Earth's rotation causes every moving thing to deviate towards the right hand in the northern hemisphere, towards the left hand in the southern. Thus there are winds so steady and sure that they won the name of trade-winds centuries ago, north-east and south-east on each side of the belt of calms in the tropics, and regular equatorial currents corresponding to them in the ocean. There are south-west winds prevailing on the western coasts of the north temperate zone—that is why the west ends of most European towns are fashionable—and currents from the south-west: the Gulf Stream for Europe, the Black Stream of Japan for north-west America. To these warm winds and currents we owe it that the British Islands are not sealed up in ice at this moment, like Labrador, which gets the same amount of direct heat from the sun. There are constant westerly winds in the region of the Roaring Forties, ridging the shoreless Southern Ocean into east-flowing rollers; and a north-eastward drift of Antarctic currents which chill the western coasts of the southern continents. Continents have an influence in chilling the air in winter and heating it in summer, so that the climate on the whole is much more severe — colder in the temperate zones, hotter in the torrid zone—over land than over sea. Wherever a steep range of mountains fronts a prevailing wind from the sea, the rainfall is great on the slope and slight beyond the barrier. Wherever a land wind prevails, or the sea-wind blows over hot, dry, low-lying land, the rainfall is at a minimum. The distribution of warmth is given on a climate map for sea-level, but the air becomes colder by 1° F. for every 270 feet of ascent above the sea. Thus, although the isotherm of 68° passes along the Himalayas on a climate map, an orographical map shows a height above 27,000 feet, and there, though no man has ever climbed so high, in place of semi-tropical heat, the Arctic cold of −32° F. is the annual average.

The Sun's heat-power, acting through air and water, is constantly breaking down the rocks of the hills and spreading the substance as soil over the lower ground. Living plants, when actuated by solar energy, re-arrange and re-combine the material of the soil and of the air, turning out partially-worked-up products, which serve as raw material for our factories. No human ingenuity can change earth, water, and air into cloth, but the Sun's energy, acting through one kind of plant, changes those dead elements into flax, acting through another into cotton, and

from these we can manufacture linen and calico. Soil and climate lead to the particular distribution of plants on the Earth.

Animals, with a higher and freer form of life, live and do their work by the Sun's power at second-hand, for they must feed on plants or on animals which are herbivorous. Each kind of animal requires a climate suited to it, food suited to it, and means of defence from enemies; and their distribution over the Earth is affected also by configuration; such barriers as the sea, great deserts, or lofty mountain ranges, sometimes confine certain species to a small area, and shut them out from lands where they are able to live and flourish if once they are conveyed there. If Nature had not been interfered with, the old black British rat would not have been driven off the field by the invasion of his grey brother from Germany.

Man is a great exception to the rules of animal distribution; no barriers stop his advance, no conditions absolutely prevent his existence. He has the power and the will to change everything else; he alters the climate of small regions in the course of time, and revolutionises the distribution of animals and plants over whole continents in a few years. Although in relation to the surface features of the Earth, man is but the creature of yesterday, history recalls changes in the distribution of the human race, and re-adjustments of the regions occupied by tribes and nations, that are as bewildering in their multitude and complexity as the growth of the solar system itself. Earth-knowledge treats man as related to the Earth, but geography in the wide modern sense looks on the Earth in relation to man, and it is this that makes geography so fascinating a study. Man, though "lord of himself, lord of the visible earth," is ultimately subject to natural laws. When, as history and the study of languages show us, nation after nation of common Aryan origin were spreading westwards in wave on wave from Asia, it was because they were compelled to do so by fiercer tribes pressing outwards from the interior, and these had to move out because a change in climate was drying up the vast inland sea of Asia. Strange as it may seem, the formation of these central Asian deserts which are now one of the chief barriers to civilisation, actually produced the highest civilisation, by driving the people into new domains where the natural conditions stimulated their development.

The great error of many geographers hitherto has been to view the world as divided into countries, and not into its natural regions. Countries are artificial and transitory, regions are permanent as far as the human race is concerned. The natural boundaries of mountain-chains, seas, and rivers do not, as a rule, define the territories of races of men, nor do races themselves constitute separate nations. A glance at Europe alone during the last hundred years reveals changes of political boundaries that can only be called kaleidoscopic. On the region between the English Channel and the Rhine, where not a stream or hill has perceptibly altered, the political geography has been changing like a pyrotechnic display. The gloom of an irresponsible monarchy was broken by the red glare of a tyrannical republic, which gave place to the purple glow of an empire that ran over the whole surface of Europe;

then the explosion of 1815 left the region referred to, altering fitfully through monarchy, republic, empire, and republic once more.

Geography has to do with all such changes of boundary and constitution, and it must take account as well of the laws, languages, religions, and customs of the various peoples of the world. All these are absolutely essential in understanding the distribution of commodities in commerce; for instance, the prosperity of Canadian fisheries depend as much on the religious observance of Lent in the Catholic countries of South America and southern Europe as on the physical conditions that fit the Great Banks to be the home of the cod fish.

The division of the world into countries is in its turn permanent, compared with the division into commercial areas. France remains a republic, and Italy a monarchy, with the same boundaries as before, but at the present time wine and silk flow less freely across the frontier than they did before the Alps were tunnelled, on account of the failure to secure a commercial treaty. The United Kingdom is one empire with the Colonies; but commercially each of the fifty-five possessions is a separate country, with its own ever-changing fixed laws and trade restrictions. Commercial geography must therefore take account of a good deal more than scientific Earth-knowledge; it may be fairly defined as a description of the surface of the Earth, with special reference to the discovery, production, manufacture, transport, and exchange of commodities. It is geography distorted so as to magnify the means of money-making, and to crowd out all considerations of moral, æsthetic, or historical interest. The coal-fields of Belgium conceal the field of Waterloo, the great shops of the Louvre shut out the museum of paintings, Washington is almost the least important town of the United States, a lighthouse is far more worthy of note than a church, Charing Cross station transcends Westminster Abbey. The scenery of Switzerland, indeed, which brings in £5,000,000 a year, the ruins of Rome, and the pictures of Florence would be touched on, but only from the gatekeeper's point of view. These resources have a unique value, for they can never become exhausted. If the people of Europe were to flock in crowds and pay six shillings a ton for the pleasure of looking at coal, there would be no dark hints as to the departing prosperity of Great Britain in a few centuries.

The commercial chart of the world constructed by Mr. J. G. Bartholomew, to illustrate a recent paper on the Distribution of Trade Centres, by Mr. A. Silva White,[1] shows the present stage of development of the Earth in consequence of utilising its natural conditions. My purpose is to indicate by a few typical examples[2] how much the development of the resources of the world, and the means of getting at them there portrayed, have been facilitated by the application of various departments of science on the part of miners, farmers, planters, fishermen, engineers, mariners. It then becomes self-evident that a comprehensive grasp of the

[1] *Scottish Geographical Magazine*, vol. iv. p. 594.

[2] For a condensed summary of the commodities of the world, see the author's *Elementary Commercial Geography* (Pitt Press Series).

leading principles and outstanding facts of Earth-knowledge will enable commercial men to seize more readily the present position of the fields of supply and demand, and to anticipate sooner the changes which are always in progress.

The chief mineral in the world both in point of utility and absolute amount produced is coal, because coal is a vast reservoir of power. Its energy is a minute fraction of the solar heat and light poured out on the strange old world that waved with tree-ferns and giant mosses in carboniferous days. When burnt it restores a part of the long-past Sun-heat, just as the movement of the hands of a clock of which the key is lost restores a part of the motion employed in winding it up. Other sources of power might be used, are being used, and will be used increasingly; but at present coal keeps our railway trains flashing to and fro across all lands, and our steamers shooting over every sea—the shuttles in the giant loom of commerce that weaves together the people and the products of the world.

Coal deposits must have existed at one time or another in all parts of the world, but in some places, such as Norway, they were worn away by natural changes before mankind appeared; in others they are buried so deeply beneath newer rocks, that we can never hope to reach them; this is the case in the south-east of England and in Holland. Wherever coal-bearing rocks reach the surface, or lie not far below, the region is capable of unlimited development, and wherever this opportunity is taken advantage of by energetic men, there is a great industrial town. In western Europe, where commercial enterprise is most highly developed, the villages which happened to stand on those unsuspected riches grew into great cities as soon as the application of steam made coal the motive power of the world. In Scotland the whole Lowland plain from the Tay and Forth to the Clyde is full of mining and manufacturing towns; in England the north-eastern section of the country as far south as the Tees owes its multifarious manufactures to coal. The woollen industry of Yorkshire, the cotton industry of Lancashire, the potteries and ironworks of the Black Country, the copper-furnaces and docks of South Wales, are each dependent on a coal-field for their supremacy as centres of population and trade. The border-line between France and Belgium runs through another such hive of industry upon a great coal-field. In Germany the coal-bearing valleys of the Ruhr and the lower Rhine, with their close-packed smoky cities, bound together by a net-work of railways, are developing manufactures of all kinds with ever-increasing success. Even a small coal-field may accomplish great things in centralising population: the few mines of the Loire field in France, for instance, keep up one engineering factory with 10,000 hands. So thoroughly versed are the Belgians and Germans in mining, and so alive to the value of fuel produced at home, that pits are sometimes sunk through quicksands, which have first to be frozen solid by a special refrigerating machine, to keep up the sides of the shaft until an iron tube is inserted. Even deposits of lignite support industrial cities on the Continent; Magdeburg, for instance, carries on its great beet-sugar manufacture with this fuel.

It is not a hundred years since a wandering hunter in Pennsylvania built a fireplace of black stones in a lonely wooded valley, and was astonished to see his hearth take fire from the burning brushwood. That was the first discovery of the great Appalachian coal-field, which now has an output second only to the pits of Britain. The anthracite that now makes the eastern part of that coal-field so valuable, was looked upon as worthless thirty years ago, for no one in America knew how to make it burn. The coal-fields of the United States—leaving lignite beds out of account—are said to cover an area nearly equal to twice the British Islands. These coal deposits and their associated iron have covered the eastern States with factories and railways, but the western States beyond the great barrier of the Rocky Mountains lie on newer rocks, and so have to depend on supplies of coal from abroad; England, Australia, and British Columbia sending cargoes to San Francisco. In Australia coal is abundant along the east coast, and especially in the valley of Hunter River. Here the black seams showing along the banks inspired the founders of a little town to give it the name of Newcastle, and the mines of Newcastle, now producing nearly 3,000,000 tons a year, have attracted a large and steady population, and made its poor harbour a formidable rival to the unequalled haven of Port Jackson, on which Sydney stands.

Those coal-fields have all been developed by the enterprise, perseverance, and resolution of Teutonic races. In Spain there are magnificent coal-beds surpassing the famous ten-yard seam of Dudley in thickness, but the commercial paralysis which prevails in that country prevents them from being worked, and the rich iron ores of the north, and the rich copper ores of the south, are either smelted with foreign coke, or shipped in the raw state to foreign works. Further away, China has coal-fields, which are said to cast even those of America into the shade, but the intense conservatism of the rulers of that ancient country has hitherto forbidden the use of steam-power or railways, and the amount raised annually is very trifling.

As long as coal continues the one source of power for the work of the world, supremacy must rest with the nations occupying coal-bearing regions, and since using coal is exhausting the supply, that will some time come to an end. Long before the six centuries, that will empty our pits at the rate of 150,000,000 tons a year, have passed, all Europe will probably be importing coals from America, and there the chief power of the world will centre, and a few centuries later the seat of empire must, it would appear, shift still further west to the flowery land of China. We can still, however, afford to smile at the prospect of an adventurous coal-agent from Kaiping travelling for orders as far as the decayed village of Newcastle, and wondering how it could ever have been worth while to span the little Tyne by a bridge which had left such gigantic ruins. Coal, on account of its many rivals, will grow scarcer and dearer more and more slowly. Europe is to be deluged, we are told, with petroleum from the giant wells of the Caspian. The Russian steamers on that sea, and the Russian locomotives on the military railway that has crept close to our Indian frontier, are independent of coal. In America too —where, thirty years ago, a man boring for brine to make salt from, "struck

oil" instead, to his disgust—there are now dozens of towns employed in raising, purifying, and forwarding the 2,000,000 tons of precious fluid which are consumed every year. Railways are too slow to carry the oil, which is pumped through lines of pipes stretching over hill and valley for 200 or 300 miles to the seaports; and continuous streams of petroleum four inches in diameter flow night and day into the tank-steamers and storage reservoirs at New York harbour and Philadelphia. The carriage of petroleum in bulk to this country was commenced quite recently, and now there are reservoirs at Barrow-in-Furness ready to supply the country. But a rival treads hard on the heels of petroleum; before liquid fuel has displaced solid, it is itself threatened by gas. In many towns of Pennsylvania, and still more in Ohio and Indiana, coal is now a memory of the past, petroleum a discarded substitute, and natural gas is the all-in-all. Iron is smelted, glass manufactured, and steam-boilers fired for factories; towns are lighted, houses are heated, with the vast supply of natural gas to which there seems as yet no end. There has been a rush of population to the natural-gas regions, and towns have been built, where factories are supplied with gas at the mere cost of maintaining the pipes.

It is interesting to observe how in old countries the towns already existing on coal-fields, changed their character and became commercial and industrial. The new castle built on the banks of the Tyne eight centuries ago, to protect the district from Scots raiders, was the nucleus round which a town crystallised; but it became what it is by taking advantage of its mineral wealth, and to such good purpose, that the very name is synonymous with "coal-town." Wherever "Newcastle" appears on the map of Australia, Africa, or America, we know that coal-mines are there. There is hardly a place-name in Britain derived from this mineral commodity, but newly settled countries are full of them, bearing testimony to the attractive force of fuel. In Pennsylvania, the map looks black and greasy with the profusion of such names as Pit-Hole City, Oil Springs, Carbondale, Coalville, and now Gastown: names which tell history.

The importance of knowing the distribution of fuel of every kind is very clear, and the commercial value of this knowledge comes out especially in times of transition, when what is perfectly suitable and economical in one place becomes inconvenient and extravagant in another. Those countries which include only regions without mineral fuel, may not remain to all time as backward as they are now. In Norway and Sweden, although the ground yields neither coal nor oil nor gas, the mild south-west winds give abundant rainfall, and the steep slopes of the hill-sides produce torrential rivers. Switzerland without coal is also a "land of streams" unfailingly fed from the snows of the Alps. These countries utilise their water-power, which is produced by the Sun every day afresh, like a watch wound up nightly, for factories, and even for mountain railways; and every year more and more of this water-power is changed to electricity. The streams of Sweden can drive dynamos to light the towns, and heat them too. The rich iron ores that are now all but useless, because the forests cannot grow fast enough to supply charcoal continuously

to smelt them, may yet be reduced by electricity, as aluminium is now being produced on a commercial scale in the electric furnace.

Precious metals and precious stones develop new countries in quite a different way; California, Victoria, New Zealand, British Columbia, and now the South African Republic have in turn been peopled by the gold fever. The alluvial deposits—that is, the gravel which ages of natural disintegration had worn from the quartz rocks—at first gave a golden harvest, and every nugget found brought a new miner into the field. Towns sprang up like mushrooms, first in canvas, then in wood, each with its hotel, its newspaper-office and store, filled with reckless spendthrift wanderers from all lands. The wealth so easily found was as easily spent; wages for ordinary workmen went up to fabulous prices: just now at Johannisberg, in South Africa, because of the gold rush, bricklayers and carpenters earn 30s. a day. In time the auriferous gravels become exhausted; it is necessary to mine the solid quartz reefs, to stamp the rock by machinery, and extract the gold by chemical processes, involving technical skill and division of labour. Capital becomes more powerful than labour, a few large companies get all the mining under their control. The town founded in haste either dwindles down, or, like most of those in California and Victoria, develops the agricultural resources of the region, and in a generation the riotous diggers, attracted by the golden bait into a pathless desert, are transformed into steady-going and prosperous farmers. It was Californian gold that drew the first Pacific Railway across the American Continent.

The growth of diamond-digging in Africa is instructive, and typical of this influence on population. The mines around Golconda had become practically exhausted a century ago, when the Brazilian diamond-fields were opened, and these in turn have lost their prime importance by the amazing development of Kimberley. When the first diamonds were found in Griqualand about twenty years ago, Kimberley, near the Orange River, could only be reached by ox-wagons journeying 650 miles from Cape Town. A collection of miners' houses grew up round a mound of blue diamantiferous clay in an almost desert region. Now it is a thriving town of 20,000 people, the terminus of a railway from the coast, its streets are lighted by electricity, water is brought to it from a distance of 30 miles, and what was a mound is now a vast open pit 500 feet deep, at the bottom of which shafts and galleries penetrate the clay in all directions, and a maze of rope-railways carries the "dirt" to the surface. The native diggers are kept close prisoners during the whole term of their service, never allowed outside their enclosure, and when discharged are subjected to the most minute examination to detect any secreted diamonds. From this town nearly half of the exports of Cape Colony is sent out every year by post registered—for diamonds are the lightest of all commodities considering their value—to London and Amsterdam. When the supply of diamonds fails, as fail it ultimately must, the frontier trade will certainly suffice to keep the town prosperous, but no less inducement than a valuable and portable product in great abundance could ever have tempted multitudes of civilised men to settle in such a desert land.

Mineral products can only be got where they are; the utmost that can be done to develop those resources is to find what the natural distribution is, and to take advantage of all conditions favourable to raising, transporting, and manufacturing them. A country dependent on mineral resources for greatness is like a man depending on a liberal expenditure of his capital for prosperity—the more lavishly he spends it the wealthier he seems, but the poorer he becomes.

Plants and animals are quite different. They are not fixed in their natural distribution; they can be carried to new regions, and their value and number increased by careful cultivation or breeding, so that a supply may be brought into existence equal to the demand. Thus there is no danger of exhaustion, and the wealth of a people in living produce is like the wealth of a person in the interest of vast capital.

Timber is the typical vegetable product of natural growth, but supplies of it do not tend to concentrate population. Clearing, not to get the trees, but to get quit of them, is necessary in settling a forest-land like eastern Canada. The very name *lumber* used there shows the esteem in which the early settlers held the timber that has come to be a chief source of wealth. Valuable trees have, however, had a certain share in settling countries. British Honduras exists as a colony solely for its mahogany; Lower Burmah was annexed mainly for the sake of its teak, and the trade in sandal-wood opened up many of the Pacific Islands.

When the Spaniards seized on America, the rich return cargo of gold and silver drew them to Mexico and the south; the east coast of North America was without profit to them, and they did not touch it. After many years of dependence on home supplies, the English colony of Virginia was able to produce in tobacco a return cargo that paid the cost of the voyage. This is one of the most instructive instances in commercial history, demonstrating not only the profit of taking advantage of natural conditions, but the principle that it does not ultimately pay to do so in transgression of moral laws. Tobacco in that hot climate required harder labour for its cultivation than the colonists could give, and they accordingly sent for African slaves. Later, when the planting of cotton had sprung into chief importance, and the cry "Cotton is king" so nearly tore the United States in two, the full consequences of this wrong step were felt. Cotton had developed the Southern States, the soil suited the plant, the climate suited the negroes. But when the national conscience awoke and abolished slavery, the result was wide-spread ruin, not alone in America, but in England, where Lancashire for a time suffered as severely as Georgia. In consequence of the drier climate of America, the inferior machinery, ignorance of coal supplies, and the want of skilled oversight or labour, cotton manufacture developed much more slowly in America than cotton growing. Britain, on account of the abundant coal and iron, the facilities for constructing machinery, and the damp climate (which receives so much abuse), but most of all on account of the working power of its people, received and worked up nearly all the American cotton. When the supply stopped during the civil war, every place with suitable soil

and climate was brought under contribution to grow cotton. The West Indies, Brazil, Southern Europe, Asia Minor, Egypt and especially the rich black lands of Western India, were soon whitening with the crop. All other textile fibres were stimulated in production, and have never lost the impetus they then received. Although after the war the superior natural conditions of America drew back most of the cotton production, the five years of forcing had strengthened the trade in several places. The fortune of Bombay, for one, was made, and Manchester suffers still from the cheaper labour of the Hindus. The growth of cotton in southern Russia has recently met with some success, and the manufacture of it is increasing in Germany, where natural conditions inferior to those of Britain are equalised by the superior technical education of the workmen. The importance of cotton cannot be overestimated; it is by clothing the world in cotton that we—the British nation—can change our coal into food. It is through cotton that Bombay has become the second city of the British empire, that Manchester has risen from the condition of a rural village, and that the Southern States of the Union, with their great centre New Orleans, have shot so far ahead of other semi-tropical countries.

At the present day wheat is the great civiliser in the vegetable world. A good wheat-growing region has verily "dust of gold." Rich soil is required, and a hot dry summer. It scarcely matters how cold the winter may be, for the young wheat plant is very hardy, but a frosty, changeable spring or a damp summer is fatal. That is the reason why no wheat is grown in Ireland, little in Scotland, and nearly all the British production is raised in the east of England. Because there are richer wheat soils in other parts of the world where land or labour is cheaper, the growth of wheat in England has been declining during the last twenty years as steadily as its consumption has been increasing. The flat pusztas of Hungary which keep the flour-mills of Buda-Pest at work; the wide belt of the black earth in Roumania and Russia, whence the Danube and Black Sea ports have become prosperous; the Nile valley in Egypt; the great fields of the Punjab, where fostered by the low value of the rupee, the extension of railways and artificial irrigation, wheat has changed the whole agriculture of the district; South Australia, where the farmers are called cockatoos, as they only need to scratch the ground to find a crop, the Argentine Republic, Chile, and California can only be mentioned.

The north-west of America is the world's chief granary, and the centre of production is the centre of the river-systems of that continent. From the gentle ridge of the height of land south-west of Lake Superior, the whole valley of the Red River running northwards to Lake Winnipeg can produce over 40 bushels to the acre (England, 35; Russia, 8); the undulating prairies rolling like a vast ocean towards the Rocky Mountains on the west, the upper Mississippi valley to the south, and the margin of the Great Lakes to the east are scarcely less marvellous in their latent productivity. This is the region of large farms: one farmer in Dakota had a field a mile wide and 40 miles long, and at harvest-time he set a hundred reaping-machines to work. This also is the region

of wheat railways, which are no less remarkable for their number in a thinly-peopled land than for the speed with which they are laid down. As fast as a new line is opened, pioneer farmers set to work to break up the stiff matted turf that covers the soil of the prairie like a tarpaulin, turning rain aside; the showers soaking into the newly-exposed soil are all that is wanted to call forth its power of raising grain. The great Canadian Pacific Railway was built for wheat, two lines along the Red River Valley were pushed northwards from the United States into Manitoba for it, and the *employés* of the different railway companies actually fought over their right to cross each other's lines, and send branches over the country to the north. Even in the northern region, inaccessible during the winter, which lasts with frightful severity more than six months of the year, the short, hot summer can mature great crops. A new route through Hudson's Bay has been proposed to bring these wheat fields nearer Britain, and at present this is a subject of keen debate, the question being whether the cold Arctic current drifting down icebergs against the mouth of Hudson Strait may not prevent regular navigation. Minneapolis, and its rival St. Paul, one on each side of the Mississippi, just below its last falls, which are utilised to drive the flour mills that have almost made British wheat-grinding a lost art, have between them more than 300,000 inhabitants. This whole region, both in the States and in Canada, is just now throbbing with the strongest and newest life of any part of the world, and what its future may be none dare predict. One thing is certainly clear, that before long steps must be taken to cultivate the land more carefully, and restore to the soil the mineral substances extracted from it by the plant, which is not done as yet, otherwise its productivity will become exhausted; but if properly managed the summer's sun will pour wealth into the growing crops, year after year, with no prospect of diminution. How much need there is for scientific Earth-knowledge, even amongst the keenest men of business of the present day, may be gathered from the fact that until a few years ago most of this amazingly fertile region which only required a turn of the plough to reveal its wealth, was classed as "The Great American Desert."

One of the distinguishing features of vegetable resources is their accommodating nature; where one crop fails another may succeed. For instance, when the coffee plantations of Ceylon were ruined by disease, the tea-plant was successfully introduced as a substitute. It is interesting and significant that many of the minor vegetable products are now procured artificially. Madder is scarcely grown at all, whereas twenty years ago it was a great crop on the continent of Europe; the identical dye it yielded can be made better and cheaper from coal-tar. Indigo dye can be made in the same way, but, so far, the artificial product has not been cheap enough to affect the production of the natural. In such cases the prudent planter should prepare himself for eventualities by finding experimentally what other useful plants will flourish in the soil and climate if the staple crop should become valueless.

Wild animals are of little and rapidly lessening commercial importance. This was not always so. Siberia was annexed by Russia, and

Canada colonised by the French in the seventeenth century, mainly for the furs they yielded; and the English Hudson's Bay Company, a fur-trading concern, held supreme political control for many years over a vast area now incorporated with the Dominion of Canada. The buffaloes, or rather bisons, once so common on the American prairies, have been almost exterminated, and the precious fur seal of the Alaskan Islands would share the same fate but for the fatherly interference of the United States Government, which limits the annual slaughter. The elephant in Africa is still an object of eager pursuit, but even in the heart of the Dark Continent this prince of big game is getting scarce. The Ivory Coast of the Gulf of Guinea is an empty name, the common place-name "Oliphant," in Cape Colony, is merely a memory. Only in the centre and towards the east coast is ivory now to be found, and the search for it, and still more the transport of it to the coast, is of necessity accompanied by the slave-trade. It would not pay to hire carriers to bring down the ivory; no beasts of burden can be used because of the fatal tsetse-fly, and if ivory is to reach Zanzibar it must reach it on the shoulders of slaves. If the complaint of the fishwife in the *Antiquary* on the perilous calling of the sea —"It's no fish ye're buying, it's men's lives"—held a sharp truth, much more bitterly is this true of ivory.

The number and utility of domestic animals is steadily increasing. It is not a generation since some Cape farmers first tried the experiment of taming the ostrich, an attempt so successful that the supply of ostrich feathers now exceeds the demand. The Cape Government attempt to keep this particular form of live-stock as a monopoly of the colony by inflicting prohibitive export duties on ostriches and their eggs; but if the demand for feathers revive, so will ostrich breeding in Algeria, Australia, and the Argentine Republic. Most of the domestic animals are of very old standing; they have been man's companions for centuries, and have accompanied him in all his world-wide wanderings. The sheep, especially the fine-wooled merino breed from Spain, has been introduced into South Africa, South America, and Australia, and in the two last-named continents the success of the experiment is unprecedented.

Australia may be said to be a woollen continent; the sheep pastures are far more important than the gold mines. Although the unexpected and prolonged droughts occasionally kill millions of them, sheep can stand heat and the want of water better than any other common animal, and there are thirty sheep in Australia for every inhabitant. Australian wool is the finest produced, and it is sent almost exclusively to the United Kingdom for manufacture. It is a striking lesson of the importance of studying conditions carefully before tampering with the order of Nature, that the worst enemy of the Australian sheep-farmers was introduced by themselves. The pastures of the continent, nibbled only by a few herds of kangaroos, have waited vacant until sheep were introduced a century since. The unusual fecundity of the sheep was noticed with delight; but no one thought of applying the analogy to other creatures. A few pet rabbits were taken to Australia to make the place look like home, and immediately they began to do mischief. Now they swarm like locusts, threatening to eat the grass from under the

sheep's noses; rabbit-killing is said to be the most prosperous profession in Australia; and it is probably within the mark to estimate the number killed every year at twenty million.

In the Argentine Republic, with somewhat similar conditions of climate, the sheep are nearly as numerous as in Australia, but produce less wool, and because of the prickly plants of the American pampas, and the carelessness of the half-Indian sheep-shearers, the fleeces are very inferior. Wool from the River Plate scarcely enters the British market, but finds its way to the United States and the continent of Europe. Horses introduced by the Spanish Conquistadors, to the terror of the natives, now run wild all over South America; and those marvellous plains of the Plate River system, one broad sea of grass and flowers, or a jungle of gigantic thistles, according to the season, afford them a secure retreat.

Cattle have also spread over the two Americas. Life on the ranches of the wild West in the United States is brightly coloured by romance; but the reckless cow-boys, hardly less wild than the Indians they dispossess, are undoubtedly pioneers of civilisation, and the Southern Pacific Railway may be pointed to as largely a cattle line. Ranch cattle have too much hard work and too many long trots in securing their living from the scanty grass and scattered water-courses of the prairies to grow fat, so the great annual cattle-drive conducts them to the rich pastures about the great rivers and lakes, where they are fattened for the slaughter. Swine, also raised in the far West, but driven into the maize district of Illinois and Ohio to fatten, exist in enormous numbers in the United States, where, it is interesting to note, cattle, sheep, and swine, each number rather over 45 millions. The great and growing towns of Omaha, Kansas City, Cincinnati, and, above all, Chicago, all depend mainly on the meat trade. Each stands in a central position for receiving the living animals and for forwarding the dead meat, and each is surrounded by grain districts where the herds quickly fatten. An idea of the present meat trade of Chicago can hardly be given, on account of its rapid expansion; but in 1887, the average rate of working was ten swine and five cattle killed, skinned, preserved, packed, and forwarded every minute day and night every day of the year. In consequence of the facilities for rearing cattle in these distant lands and the recent improvements in carrying living animals and fresh meat, the cattle of western Europe are diminishing in number, but improving in quality, being kept more largely for dairy purposes and for breeding than for the supply of hides, tallow, and meat.

From these typical examples, it is plain that commodities have exerted the chief influence on the growth or origin of new centres of population and of trade within recent years.

No fact has been more fully established than this, that for any human redistribution of substance or power in the world to be of permanent advantage, the slowly accumulated resources must be very sparingly drawn upon, or they will become exhausted; while the daily renewed supplies of solar energy and its immediate derivatives, wind and water-power, and the unceasing growth of plants and animals must

be increasingly utilised. Even in the timber trade of thickly afforested countries it is found necessary to plant new trees, as the old ones are cut down, so that there may be always an unchanged supply of leaf laboratories transmuting sunbeams into solid wealth.

A glance at the lines of communication which bridge the distances of the world, reveals equally the value of Earth-knowledge to the commercial man. The permanent winds and the currents of the ocean have been studied, and are daily taken advantage of in the great sea-routes. Sailing ships continue to carry much of the New Zealand trade, and they make the outward voyage from Britain always by the Cape of Good Hope, and the return voyage always round Cape Horn. This particular course is fully explained by the "brave west winds" of the Roaring Forties. Steamers have been sent home from Australia by the Cape of Good Hope; but the natural conditions are too strong, and every attempt in this direction has been abandoned. The great-circle course on this voyage is far shorter than the Mercator; but the difficulty of working out such courses on a flat map has greatly impeded their use by ordinary sea-captains. The simple circular maps invented by the late Mr. R. A. Proctor have made great-circle and composite sailing as easy as that on a rhumb line. Yet this shorter passage is not taken on the New Zealand voyage when a nearly Mercator course is held from the Cape; the fact that the shorter route carries them into high latitudes, where the seas are crowded with drifting icebergs, long ago convinced the mariner that in this instance the longest way round is the shortest road home.

That there is a future for commercial enterprise in the long frozen waters of the Arctic Sea has been fully demonstrated by Captain Wiggins, and arrangements have now been made for establishing a regular summer sea-trade with Siberia, the British ship-owners, who are taking the matter up, undertaking to carry their cargo to the mouth of the Yenesei, where a Russian firm will undertake the 1500 miles of river navigation to Yeniseisk.

The Suez Canal, by changing the road to India and the East, has had a powerful effect in restoring to the Mediterranean shores much of the prosperity that the discovery of America took from them, and at the same time the importance of London and other British ports as entrepôts has notably declined. Canal-making in the East is not at an end. As India grows in commercial prosperity her merchants will cease to tolerate the great detour round Ceylon which lengthens the voyage from Bombay to Madras by one quarter, compared with the route through the Strait of Manar that a canal across Adam's Bridge would open to large vessels. And similarly on the route to China the Isthmus of Kraw may some day be cut. A redistribution of trade-centres of a very interesting kind would accompany this achievement, for Singapore, the greatest business harbour of the far East, will be left far off the main track.

The Panama Canal may never be finished, and, indeed, the French Darien experiment threatens to become as sad a failure as the Scottish, not on account of natural obstacles, though these were greatly underestimated, but because of the "Monroe doctrine" of the United States, which forbids any European power to attempt to bring order out of the

chaos of the quarrelsome Spanish-speaking republics. There seems little doubt that within a few years, if the present unfortunate project is not completed, the United States, out of their immense accumulated wealth, will carry out their favourite scheme for crossing the isthmus through Lake Nicaragua. When this happens, Liverpool, which is now only 5 per cent. more distant by sea from San Francisco than is New York, will be lifted back relatively and set down at a distance 96 per cent. greater than the rival outlet of the industrial Eastern States, but there will be ample recompence to British trade for this loss. The new mail route to Australia will probably traverse this canal, and because Panga Panga will thus become an invaluable coaling station, the control of the little Samoan group has assumed a very important place in European and American politics.

Land communication is, however, a greater problem. The trans-continental railways of America have exploited new country, and carried out the people to cultivate the land, but they have also opened the quickest route to the far East, realising in a sense the dream of Columbus. Tea from China comes most rapidly to the British market by rail across America, and mails from Australia are sent by the same route. Thus the lonely group of Sandwich Islands, in the middle of the Pacific, owes its prosperity to a railway 2000 miles away; and how great this prosperity is, outwardly at least, may be judged from the fact that Honolulu, the capital of the "Cannibal Islands," has a more complete telephone system than any town in Britain. The Canadian Pacific Railway, second to none for the engineering skill involved in its construction, will make the way to China four days shorter than any other route, once the special lines of Atlantic and Pacific steamers are fairly started in connection with it. This route beats all others across America, not only in being shorter, but because at each terminus there is an active coal-field where both trains and steamers can take in supplies of power for their journey at the cheapest rate. In transport it must be remembered that cheap power and an easy road are the prime requirements.

Australia is being developed in its inland communications also. The eastern capitals are strung together by rail, though the independence of the respective colonies has led to each having its own special gauge. A trans-continental line following the overland telegraph wire from south to north is a project approaching realisation.

In Asia the iron-horse is beginning to scent his chief triumphs. This continent, with half the population of the world, is practically untouched by rail, except in the Indian peninsula and along the Russian line of military advance towards Afghanistan. The natural difficulties it presents to a complete railway system are enormous, but the practical inducements are greater. Russian surveys have been made, and a scheme set on foot for carrying a line across the level plains from the Urals to Lake Baikal at the northern base of the great heights, and then across the mountains to the Amur Valley and the Pacific. There the Russian port Vladivostok—Ruler of the East—is already in telegraphic communication, by a wire along the camel track with Europe, and seems destined to play a leading part in the future development of the would.

From the considerations that I have mentioned, and from observing the effect of a wider education on the business men of other countries, scientific Earth-knowledge, by whatever name it is called, appears to the most thoughtful statesmen and merchants of the day, not only an aid but an increasing necessity for commerce. It is particularly of value in enabling the channels of communication to be foreseen, and the results of change anticipated. For this purpose geography, in its narrow sense, is not enough. There were men in Europe who had keen political foresight when the Vienna Congress settled national boundaries in 1815. They certainly made a political blunder in forming Belgium and Holland into one country, but it may be questioned whether their diplomatic descendants in the great continental governments do not think they made a worse blunder in ignorantly apportioning so large a share of the great coal-field of western Europe to the little state of Belgium. Steam-power was such an infant at that time that only a scientific-poetical mind, like that of Erasmus Darwin, could foresee the time when it would work the world, and coal become more precious than gold. To the politicians who drew the line between Canada and the United States, it was probably a matter of slight moment whether the Falls of Niagara should belong to one side or the other, but to the politicians of the future this will become a question of vital interest on account of the immense energy which the fall makes available, and which assuredly will one day be taken advantage of.

What features of the Earth's surface may become important it is very difficult to say; the question needs to be carefully investigated. The facts need first to be ascertained; most countries see this, and maintain geological surveys and forest and agricultural departments. Already enormous masses of information are available, but it is no one's business to discuss them. They emerge from obscurity into the uncertain light of the columns of a blue-book, and sink into obscurity again in the dusty recesses of a few libraries. The facts sometimes are striking enough to produce a leading article in a newspaper; there may be merchants who study the original documents, and profit by them; but the community benefits very indirectly by that. Such publications as the *Board of Trade Journal* properly confine themselves to matters of commercial importance to-day, but in this age it is well to know something of what may be of commercial importance to-morrow. In order to do this, the scientific results of specialists must be discussed by a scientific generaliser, before they can become available to all.

More than thirty years ago a Chair of Technology was founded in the University of Edinburgh, and the brilliant lectures of Professor George Wilson are not yet forgotten; but, just as the great Museum, in the prospect of which the Chair was instituted, had received a home, and become available for teaching purposes, the Professorship ceased to exist. Technology, as understood when the Museum of Science and Art was founded, has received a larger interpretation in recent years in many technical colleges, where its various branches have separate Chairs devoted to their study and teaching. But there is real room, and serious need for systematic and authoritative teaching (and as a necessary preliminary there must be systematic and original study)

of the great principles of science in their application, or rather their applicability, to commerce as distinguished from industry. Something more than the *Handelsgeographie* of the German, Austro-Hungarian, and Swiss schools is required, and this cannot be given without the devotion of much time, nor can it be conveyed to the learner without a far greater expenditure of money in maps, diagrams, and specimens than has yet been considered necessary in this country. Rather than the subject of "Commercial Geography," as usually understood, and as sometimes taught, I should feel disposed to make the experiment of teaching Applied Physiography or Practical Earth-Knowledge as one subject, and topographical, political, and economic geography as another. The former would imply the resuscitation of the Technology Chair on a basis wider in its grasp of the grand unifying principle of the Universe, not fully understood thirty years ago—the doctrine of matter and energy—narrower in the less detail given to subjects with which the special Chairs of engineering, practical chemistry, agriculture, and other arts more properly deal. The latter would correspond more nearly with the *Handelsgeographie* of the Germans.

TRIDACNA PEARLS.

By H. B. Guppy, M.B.

Although here and there one may find a brief reference to the occurrence of these so-called clam pearls in the large bivalves of *Tridacnæ*, yet it is not often that mention is made of their characters as precious stones. In the article on pearls by Mr. F. W. Rudler in the last edition of the *Encyclopædia Britannica*, clam pearls are not referred to; nor does Mr. Streeter in his *Precious Stones and Gems* (1877) give any particulars about them. In the hope that these remarks of mine may be the means of establishing a new industry on coral islands, and of giving a fresh field to Mr. G. C. Ross of the Cocos-Keeling Islands and to my old acquaintances in the Solomon Group, I venture here to call attention to the subject; and I may safely promise any enterprising firm in this country that if they choose to take the matter up and create a demand, there will be no lack in the supply.

Mr. H. Stonehewer Cooper, in his *Coral Lands*, 1880, and in the more recent form of that work, *The Islands of the Pacific*, 1888, quotes from a report of Mr. Sterndale to the New Zealand Government, in which it is remarked concerning Tridacna pearls that good specimens are rare, the great majority being irregular in shape and opaque-white or milky in appearance. In this respect my experience coincides with that of Mr. Sterndale, and I may add that these pearls of inferior quality are illustrated in the shell collection of the British Museum. Two pearls are described in this report as the best that had come under the author's notice. Both had a crystalline lustre and a central luminous point, one being of the size of a pea, round on one side and flat on the other, the

other lens-shaped and half an inch across, for which Mr. Sterndale offered 1000 dollars. My examination, however, of a considerable number of clam pearls leads me to believe that good specimens with a crystalline lustre and a luminous point are very rare, and that those which will be in future regarded as the usual type of a good Tridacna pearl will be those possessing a symmetrical ovate or peg-top form, and a semi-opaque or milky-white colour.

Through the instrumentality of Mr. G. C. Ross I recently had an opportunity of examining about 900 Tridacna shells at the Cocos-Keeling Islands; and I was enabled to make some notes on the mode and frequency of occurrence of their pearls. These concretions are nearly always to be found imbedded in the outer surface or back of the mantle, and lie generally just beneath the skin of the median fold corresponding to the hinge. The larger specimens, on account of their weight, are very liable to drop out unnoticed whilst the shell is being examined, or even during the act of raising the shell from the water, a circumstance that partly explains the rarity of the first-class pearls. Of the 900 shells that I searched, about 100 belonged to the largest species of *Tridacna* (*T. gigas*), of which about one-fourth yielded semi-translucent pearls varying, usually in size from a large rice-grain, which they often resemble in appearance, to a mustard seed; in form rarely symmetrical; and apparently of little value. In some instances these pearls were very numerous, and were, so to speak, dusted over the back of the mantle. The largest specimens were irregular in shape and half-an-inch across.

By far the greater number of the shells examined belonged to a smaller species of *Tridacna* that attains a length of about 15 inches. These shells had the reputation in these islands of possessing the best pearls, an opinion which I was able to corroborate, although, after searching about 800 of them, I was unable to find a first-class specimen. The pearls are opaque-white, usually roundish, yet rarely symmetrical, and vary in size from half a line to a third of an inch, every fourth shell possessing two or three pearls. I estimate that a thousand of these shells will yield from 25 to 30 pearls, fairly symmetrical, not less than one-quarter of an inch across, and capable in a few instances of being mounted. In addition, there would be about 100 of smaller size also of fairly good shape, and, if skilfully mounted, often suitable for ornaments; and besides, there would be 400 or 500 shapeless concretions of no value whatever, though on account of their hardness they might prove useful to a watchmaker. If, however, my experience is typical of its kind, not one of these thousand shells would contain a really first-class pearl. It should be remarked, however, that results may differ with locality, since even in the lagoon of the Cocos-Keeling Islands the most likely shells for good pearls are said to be found near and in the passages between the islands. Probably enough, the least protected atolls—those, in fact, possessing lagoons well open to the sea—will afford the most promising localities; and the same remark would apply to the lagoon channels of barrier-reefs. A certain amount of motion of the mantle would seem to be necessary for the rounding of these concretions; and it would appear that the shells living in the shallow running water of the passages through a reef would be

more likely to produce symmetrical pearls than those found in the quieter and deeper water of the interior of a lagoon.

I should again remark that symmetrical pearls are rare, whether they be such as Mr. Sterndale describes, or whether they are like those that have come under my notice. These are five in number, being semi-opaque or milky white, and ovate or peg-topped in form. One from the Solomon Islands I gave to Mr. Edgar Smith. Mrs. Ross has a handsome specimen about an inch in size; but its blemish lies in its complete opacity. A small one I have given to Mr. John Murray.

As I believe that many of the finest pearls drop out of the shell, I would advise those who may continue the search to be very careful in handling the shells, and to open them over a tub of water. Mr. Ross found a good specimen on the bottom of the boat in which the shells had been collected. Sometimes it will be found that these concretions take curious shapes, such as that of a tusk and a crescent, when usually they are attached to the shell.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

THE last Ordinary Meeting of the Session was held in Dowell's Hall, Edinburgh, on 8th May—Dr. John Murray in the Chair. A Paper on "The Kara Sea, and the Route to the North Pole" was read by Captain Hovgaard, of the Danish Navy, and elicited an interesting discussion. The paper, and a report of the discussion, will be be published in a subsequent number of the Magazine.

GEOGRAPHICAL NOTES.

EUROPE.

The Shipbuilding Statistics of the United Kingdom for 1888, showing an increase over 1887 of 330,000 tons, have been summarised as follows :—

	Tons.		Tons.
North-Eastern Ports (England),	506,897	Aberdeen,	6,640
Clyde,	280,037	Londonderry,	4,813
Belfast,	35,495	Grangemouth,	4,556
Mersey,	19,725	Barrow,	635
Dundee,	11,107	Thames,	297
Southampton,	10,161	Various Ports,	9,171
Humber,	7,346		
Leith,	6,807	Total,	903,687

Leaving the miscellaneous ports out of account, we have the following :—

	Tons.
England,	545,061
Scotland,	309,147
Ireland,	40,308

Russian Expeditions in Europe.—The following Russian expeditions in Europe are announced for the forthcoming summer :—M. Faussek, the explorer of the

northern provinces of Russia, is to continue his investigations on the shores of the White Sea, from Ssumsk to Kandalaksha; the geologist, M. Andrussoff, is to make a trip to the Eastern Caucasus; and M. A. Krasnoff, known for his botanical work in the Tian Shan, will carry out similar investigations in the middle provinces of European Russia. Local magnetic phenomena will be observed in the government of Kharkov. An expedition, equipped by Government, will proceed to the Timan Range for cartographical and topographical purposes. The Russian Geographical Society recently undertook an interesting inquiry, under Major Michailoff, into the secular rise of the Finnish coast, which has been periodically observed for over a century. The results appear to have varied in different places. The least difference of level in thirty-three years (1836-1869), at Lechte, was 3·8 inches; the greatest in thirty-three years (1839-1872), at Hangöudd, was 11·11 inches.

AFRICA.

A New Entrance to the Zambesi River has been revealed by Mr. Daniel J. Rankin. Mr. Rankin was last year appointed by the Council of the Royal Scottish Geographical Society to explore the Loango-Zambesi basin, but, owing to the disturbances in the Interior, he has been obliged to confine his attention to the Zambesi delta. He has already sent to the Society some tracings of his surveys, which are subsequently to be combined and presented in a new chart of the delta, accompanied by descriptive letterpress. In his last letter to the Secretary, dated 20th February 1889, he says:—"I have the pleasure of forwarding by this post a sketch survey of a new entrance to the Zambesi discovered by me. As you are well aware, this river has hitherto been approached either by the river Quaqua and the overland route to Vincente, or by the Inhamissengo mouth [of the Kongoni entrance to which Mr. Rankin had previously sent a survey, now embodied in the Admiralty chart *Africa, East Coast*, 2865]. Both of these have very many important disadvantages. The Chinde mouth of this river, in lat. 18° 34′ 30″ S., long. 36° 29′ E., appears to have been altogether overlooked. Its future importance to trade in this country can scarcely be over-estimated, for the three fathoms on its bar will allow of the Castle Packets entering, and produce and goods being transported to and from the upper waters of the Zambesi and Shiré rivers without encountering any of the grave obstacles that have hitherto served to stifle trade development. The Chinde river connects with the Zambesi a few miles above the Madredani, about twenty miles from its mouth, having a winding though deep channel all the way, while at its junction with the Zambesi it has no bar. I am forming a general map of the Zambesi delta for your Society, with a descriptive paper illustrating the physical features, government, etc., of this large district. Owing, however, to enforced alterations in my plans I cannot send it by this mail. The disturbances on the coast have, it gives me deep regret to say, postponed my intended departure into the Far Interior for an indefinite time."

The Secretary sent Mr. Rankin's tracing to the Hydrographic Department of the Admiralty, in acknowledging which the Hydrographer, Captain Wharton, said: "I must demur to the term 'discovery,' as the entrance is shown upon the chart of the river Inhaombe, but we have no detailed information on its value or its especial dangers."

Senegambia.—Dr. Colin, who in the early part of last year carried out some explorations between Bambook and Futa Jallon, contributes to the *Compte*

Rendu (2, 1889) of the Paris Geographical Society, a brief paper from which we extract the following :—Starting from Kayes on 24th January, 1888, he reached Khassama, the capital of Diebedugu, by a route pretty well known. Some corrections to the map he, however, has to make. The position of Bundéri (a village of Niambia, on the Tambaura plateau) in relation to Diokhéba, is wrongly given. The map of M. Plat places Diokhéba at a distance of 18 miles from Bundéri ; in reality it is only 4. Dr. Colin stayed near Khassama for a couple of months, and from thence made his explorations. His work, added to that of the recent surveys by French officers, has resulted in a more correct map of the district being attainable. The upper course of the Falémé, for instance, is found to be different. It is not prolonged in a direct line to the neighbourhood of Labé, in Futa Jallon, but bifurcates, between Satadugu in the north and Irimalo in the south, the two streams being of about equal size. The western branch is called the Bâ-lin-ko ; the eastern branch preserves the name of Falémé. On his arrival at Irimalo, from Satadugu, Dr. Colin ascertained that the river upon which the place is situated is the Bâ-lin-ko and not the Falémé. To test the accuracy of this, he took a boat and the following day reached the confluence, after voyaging a distance of 24 miles and passing fifty-one rapids. This spot is called by the natives Fékolo, which Dr. Colin ascertained to be in about 12° 26′ N. lat. and 13° 39′ W. long. A sketch-map accompanies Dr. Colin's paper.

Galla Country.—M. Borelli, after three years' residence in Shoa and its tributary States, has gone further than his predecessors in the Galla country. He reached, by way of Jimma, the confluence of the Godjeb with the Omo (Uma) and the little kingdom of Kullo (*Compte Rendu*, Paris Geographical Society, 1888, p. 511). The Omo, according to him, is not the upper course of the Juba, but flows into a lake called Shambara under 2° N. lat. and 35° E. long. Not far from this spot lies Count Teleki's recently discovered Basso Narok (*vide S. G. M.*, vol. v. p. 97), which, however, stretches northwards to about $4\frac{3}{4}$°, where Borelli, who could have had no information of this discovery, makes the Omo to flow. It is quite possible that Borelli's Shambara is identical with the Basso Narok, or Rudolf Lake ; and equally possible that it is identical with the lake Baro repeatedly reported by explorers of the northern Galla country, and from which the Nile tributary Sobat was made to take its rise. Whether the Shambara had an outlet, M. Borelli was unable to accurately ascertain. *Petermann's Mitteilungen* (iii., 1889), from which the above is taken, states that Count Teleki discovered no outlet from the north end of the Basso Narok.

AMERICA.

Jade in Alaska.—Lieutenant G. T. Emmons, who is continuing his researches in Alaska, recently made an interesting find at Sitka. He writes : "A boulder of jade was dug up on the site of the present Indian village, at a depth of some 3 feet, in loose black soil. Two pieces have been cut from it for knives or adzes, each about 20 centimètres long, from 3 to 4 centimètres wide, and from 1 to 1·5 centimètres in thickness. The three faces on which the boulder has been cut are highly polished, and show a mottled green surface, ranging in colour from a yellow green to a rich dark green. After the pieces were cut down on either side, they were broken from the body of the boulder by a shock, probably by means of a wedge. On another side, where a wedge-shaped adze could be removed with the least work, a cut has been commenced, forming a somewhat irregular groove, following to some extent the irregular surface of the boulder. It is 12 centimètres long, and 0·2 of a centimètre deep. From

inspection, I should say it had been worked by means of a stone knife, or the edge of some siliceous rock not having a cutting edge of more than 2 or 3 centimètres at the greatest. The whole boulder is wedge-shaped, and 29 centimètres in length. Its weight is a few ounces less than 20 pounds. The four faces are of olive green, the more prominent rounded surfaces being veined with a rich dark green. In my collection in the American Museum of Natural History there is a small nugget about the size of a hen's egg, with a groove in it; a dark green jade; and I have also in my possession a piece of unworked jade of a rich sea-green, which I found an Indian wearing as a scratcher. It has well-rounded edges and well-polished surfaces, proving long wear. Among forty-three pieces I have collected among the Tlingit, these are the only ones that show that jade has been worked on the spot. Jade has been used for implements, generally for adzes, axes, or fighting-picks, the last mounted in wooden handles." The finding of this boulder of jade showing worked surfaces is important, as it proves that the material was found and worked in Southern Alaska. It will be remembered that Dr. G. M. Dawson found a boulder of the same description on the Lower Fraser River, and that Jacobsen and Dawson found boulders of this material, although the rock has not been found *in situ*. Lieutenant Emmons adds that he is very hopeful of finding the exact locality from which the Alaskan jade is obtained, as he received trustworthy information referring to this interesting question from the natives.—*Science*, 1st February 1889.

Saco River.—Mr. John M. Batchelder, Cambridge, Mass., supplies the following dates of the opening and closing of the Saco River in that State, as observed by him for a series of years beginning in 1820. The Saco is situated in lat. 43° 31′ N., long. 70° 26′ W.

Year.	Opened.	Closed.	Year.	Opened.	Closed.
1820	.....	30th November	1834	21st March	.....
1821	5th April		1835	6th April	30th November
1822	12th March	.....	1836	12th April	15th December
1823	7th April	.....	1837	16th April	10th December
1824	16th March	10th December	1838	26th March	25th November
1825	19th March	11th December	1839	26th March	18th December
1826	12th April	22d December	1840	20th March	1st December
1827	24th March	20th December	1841	31st March	19th December
1828	20th February	22d December	1842	12th March	28th November
1829	6th April	.....	1843	17th April	1st December
1830	18th March	27th December	1844	29th March	28th November
1831	23d March	2d December	1845	27th March	3d December
1832	1st April	.....	1846	24th March	3d December
1833	1st April	.....			

AUSTRALASIA, ETC.

New Guinea.—The Rev. James Chalmers, our Honorary Corresponding Member, writes to us from Motu-motu, under date 23d January:—"This is a new mission station, just founded, and at present the furthest west, near the Fly River." The people, who were formerly the terror of the coast, he finds to be very friendly, and by far the most "dressed" Papuans yet seen, delighting in a lavish display of paints, feathers, shell ornaments, and variegated leaves and flowers. Mr. Chalmers expresses the belief that Port Anderson and Port Blemfield will ultimately be of importance; and he promises notes of a journey he is about to take up a neighbouring river as far as Mount Yule.

Butaritari Island in the Gilbert Group.—Butaritari, or Great Makin, Island is situated on the weather or southern border of a completely developed atoll, the lagoon of which has an extreme length of 12, and an extreme breadth of 8, nautical miles. The narrow strip of land, raised only some 15 feet above the sea-level, and from 650 to 850 yards wide, is everwhere covered with coco-palms. The entrances to the lagoon are narrow and have a depth of from 3 to 7 fathoms: the interior affords good and safe anchorage in depths of from 6 to 20 fathoms.

The natives, numbering some 800, are a peaceful people under a chief, or so-called king. An American missionary resides on the island. They live chiefly off coco-nuts and a species of yam.

The above information is supplied to *Annalen der Hydrographie* (xii., 1888) by Captain Diekmann, of the German barque *Paula*, who, with the assistance of a native pilot, drew up the map of the island that accompanies his communication.

This triangular atoll is also known as Tari Tari, or Pitt's Island; and from its singular shape, in which respect it agrees with the majority of the other atolls of the group, it may be inferred that these reefs, as pointed out by Dana, are not always annular.

GENERAL.

The Mean Altitudes of Africa and Asia.—In 1881 M. Chavanne, for the first time, estimated the mean height of Africa. A more recent estimate, based on the hypsometrical map to Habenicht's special map of Africa, has been made (*Petermann's Mitteilungen*, vii., 1888) by Herr Franz Heiderich. The mean height of Africa is given by Heiderich at 673 metres (2208 ft.), which approximates to the 661·8 metres of M. Chavanne. Herr Heiderich has elsewhere estimated the mean elevation of the Pamir plateau at 3790 metres (12,434½ ft.). He considers the mean height of Asia (500 metres, or 1640½ ft.), "hitherto accepted," as being much too low, and says that if the Pamir plateau mass were evenly distributed over the whole of Asia, it would raise the continent by 15·5 metres. Possibly, however, Herr Heiderich had not read Dr. Murray's paper on the *Height of the Land and Depth of the Ocean* (*S. G. M.*, vol. iv.), wherein the mean height of Asia is given at 3189 ft. (first estimate), and 2764 ft. (second estimate). In the same paper, the mean height of Africa is given at 2021 ft. (first estimate), and 1741 ft. (second estimate).

The Study of Geography.—At a meeting of the Aberdeen Branch of the Society, on 24th March last, Prince Krapotkin gave a lecture on "What Geography ought to be," of which the following is an abstract:—The lecturer observed that the aim and scope of geography were so wide, and so much had been written of late upon the subject, that he merely intended to give a few illustrations to show the real scope and aims of modern geography. His illustrations would be taken from recent Russian explorations in Asia, not that they were more appropriate for illustrating his ideas than modern researches in other parts of the globe, but because his Scottish fellow-geographers would probably be more pleased to learn about some of the less-known explorations recently made in Russia. The lecturer also added, that his ideas on geography might be considered as fairly representative of the views held by geographers in Russia, recently expressed in a memoir published by the Council of the Russian Geographical Society.

The lecturer then proceeded to discuss some of the objections raised against geography as a science. It had been said that geography covered so great a variety of departments of natural science that it had none of its own. The geologist had

taken possession of the modifications of the earth's surface; the meteorologist, of the life of the atmosphere, and so on. Nothing was left to the geographer; so that it had been remarked that the geographer was very much in the position of Schiller's poet, who had found nothing on the earth to take possession of—everything already having been appropriated by somebody. But, as Schiller had so beautifully met the difficulty by directing the poet to the study of the human heart from a higher point of view, so he would say, that the geographer, too, had to ascend to a greater height and consider all the phenomena separately described by specialists in the broader view of their natural dependency and their general consequences. Taking advantage of the work done by the geologist, the meteorologist, the biologist, and the sociologist, geography had to become the science of the life and evolution of the earth's surface, with all that lives upon it, and all that influences its life. As to the reproach that geography was a merely descriptive science, it was still less founded. Mere description, without some leading idea in it, was utterly impossible. Suppose somebody tried to describe that audience, he would never finish if he attempted to describe every small detail of character in every person present. The realistic school of France was trying to do something of the like, to describe the small details of life; but after having accumulated mountains of details they were no more instructed about human character than before they read the books of that school. No description was possible without a certain classification, and classification became scientific only when it was based on the laws of evolution of the things classified. Zoology, botany, anatomy, and mineralogy were examples in point. So it was also with geography. It could not merely describe without, consciously or unconsciously, going into the origin of what it described. We could not describe a plateau, a mountain tract, a lake region, or even a river, without implying some admission as to the origin and the life-history of the river, the lake region, the mountain tract, or the plateau, nor without taking into account the variety of causes which still modified those features of the earth's surface.

Exhibiting the excellent geological map of Lake Baikal by M. Chersky (published by the East Siberian branch of the Russian Geographical Society), the lecturer remarked that, from the very first steps of his description of Lake Baikal, the geographer would be struck with the great difference of depths in the southern part of the lake, where it reached 4720 feet, and the northern part, where it was supposed not to exceed a few hundred feet. An island on the west coast and a promontory on the east coast marked the division, and a submerged threshold, covered with only 180 feet of water, connected the island with the promontory. Now, it was evident that it would be absolutely contrary to human nature to mention the fact without attempting to explain it. It was hardly possible to give the description without making some hypothesis as to the origin of the lake, as every geographer did. When mentioning Lake Baikal, some added that it was a longitudinal valley between two chains of mountains; they discussed its origin, and, while some were inclined to admit the volcanic origin of the depression, others preferred to ascribe it to aqueous causes. A whole series of hypotheses was thus made, and they proved all not to be in accordance with facts. The lecturer then entered into some details as to the complicated character of the lake, composed of at least two valleys running south-west and north-east; and he compared the Siberian lake to the Ural mountains, which consisted of several chains running in the same north-east and south-west direction, and situated so as to make the impression of a mountain tract running from north to south. Taking, then, the Caspian Sea—which, the lecturer said, would appear as a photographic negative of Lake Baikal if its level were lowered by a couple

of hundred feet—he proceeded to show the striking analogies between the two lakes, their position with regard to the plateau and its border ridge (which, in the case of the Caspian Sea, ran from the south-east to the north-west), their depths, their division into two basins, and so on; and he gave a short sketch of M. Andrussoff's researches into the geological history of the Caspian depression and the bearing of those researches upon the origin of depressions generally. A mere description of Lake Baikal was thus leading to a series of comprehensive aspects of the evolution of the earth's surface and its present life.

Taking another example from the vegetation of the Tian Shan Mountains, the lecturer pointed out, on the basis of M. Krasnoff's recent work (*Sketch of the Evolution of the Flora of Tian Shan*), how a simple attempt at describing the flora of the region would lead the geographer to a wide inquiry into the causes which gave to the Tian Shan flora its present character, and determined the whole history of Central Asia. Suppose, for instance, they were travelling from south-east Russia to the Tian Shan range. While crossing the dry Aral-Caspian depression they would be struck by the totally new character of vegetation. But, when reaching the northern slopes of the Tian Shan, they at once would find themselves amidst their old European acquaintances. However, they would soon discover that, besides their old acquaintances, there were a number of plants that did not belong to the European flora, but were such plants as are capable of living in a very dry climate. Some European plants would appear dwarfed, and while on the northern slopes the immigrants from Central Asia were not numerous, they grew in numbers up the southern slopes. Now, of course, they were bound to explain these facts, and in trying to do so they were compelled to study the desiccation of Northern Asia, which had gone on at a remarkable rate since the Glacial Period, and they would soon find out how the present flora of Turkestan must be considered as a compound product of a long struggle for life, accommodation, and the immigration of new species. On the other hand, from the ruins of towns which were met with in such numbers in Eastern Turkestan, they would suppose that, at a not very distant period, the region was inhabited by a comparatively dense and rich population. The lecturer asked whether the desiccation of Eastern Turkestan did not also explain the great migration of Asiatic tribes during the first centuries of our era, driving before them new tribes, and driving so many of their *débris* to the plains and valleys of the Caucasus? This cause—the desiccation of Asia—seemed not yet to have been sufficiently taken into account, because the speed of desiccation has been underrated. Showing M. Yadrintseff's maps of the lakes Tchany in Western Siberia, made in the last century, in 1824, and in the last decade, the lecturer showed how, within a period of fifty years these lakes had nearly disappeared, and how what had been their bottoms sixty years ago was now covered with villages; and he entered into some further details upon the rapidity of desiccation, and its bearing upon geography and history.

Summing up the conclusions which could be drawn from the foregoing examples as to the limits of geography, the lecturer concluded as follows. It therefore came about that in geography there were three great branches of scientific study. First, there was the study of the laws that governed the development of the surface of the globe, which was connected to some extent with geology. In that sense, geology and geography met together in a common field and supplied one another with data. Second, there was another great branch, climatology—not the study of the laws of the movements of the atmosphere, which is the proper domain of meteorology, but the study of the *climates* of different regions in their dependency on all other features of the earth's surface. The third great

branch was the study of the geographical distribution of animals and plants, and the development of floras and faunas. These were the three separate branches, but there was another most important branch, which treated of the distribution of human societies, of human families, of human races, the branch that was sometimes described as anthropology, but had the same relation to anthropology as climatology had to meteorology proper. All showed that there was a great task for the geographer, but in his opinion there was another task for him, which might be still more important, and that was the task of showing that every nationality was bearing its own part in the development of humanity. That was an idea which, though simple, was not sufficiently recognised. How much prejudice did there exist with regard to the different nationalities, and not only with regard to nationalities far distant from one another, but even those separated by a mere channel. He thought that the duty of the geographer was to show that, although there were very great differences in the manner of life of the middle and richer classes, yet there was a stock which was common to all nationalities, and there was the greatest likeness between the masses and the workers of all nationalities in the world. As a means of their becoming acquainted with people of different nationalities, and especially as a means of children entering into relations in this way, he mentioned the Agassiz Societies that existed in America, whose members made collections of minerals and plants, and so on, and entered into relations with schools in England, Scotland, and Switzerland, and exchanged their collections, wrote letters to one another and described the scenery of their country. That, he thought, was a very excellent thing, and could not be too heartily recommended by all who were interested in education. Now that he had entered on the subject of education, perhaps they would permit him to make a few remarks on geography as a subject of education in schools. He thought there was no more attractive science to children than geography. He did not assert it was, but it could be. As a matter of fact, children did not take a very lively interest in nature as long as they did not see Man behind the plants or the animals; they were living at a period in which imagination was a chief element. It was quite natural that while they particularised vegetation, children would not listen very attentively, but as soon as they described it in the form of some one having gone to explore unknown parts of the world, immediately the attention of the children would be awakened; they might speak of bays and creeks without arousing the slightest attention unless there was a ship at anchor, and somebody landing upon unknown shores and finding savages with strange customs, and fighting for mere existence in the forests of the country. On the other hand, geography, if it were properly applied, was a most powerful instrument for giving that humanising education which up to the present had been obtained through the study of only Roman and Greek antiquities. The lecturer offered some illustrations to show how the study of primitive human societies, and the comparative study of the inhabitants of the globe, their customs, their traditions, and the like, could be used as a substitute for the humanitarian education at present intended to be given by the study of Greek and Roman history; and he pointed out that that branch of geography was to show us, who despised the savages and civilised them with whisky and kidnapping, and how both to understand them and to treat them properly.

In conclusion, the lecturer remarked that, viewed in this light, geography became a summary of all the partial results obtained in school in the separate sciences, and that in the hands of an able teacher it ought, besides conveying positive facts and developing a taste for geographical exploration, to convey

also a general view of Nature and human societies, and to become a kind of Philosophy of Nature. It was not by a simple accident that the *Kosmos* was written by a geographer. Humboldt had shown us in that work what was the real province of geography in the cycle of sciences.

MISCELLANEOUS.

M. R. de Lannoy de Bissy has finally completed his great **Map of Africa**, in 63 sheets, and on the scale of 1 : 2,000,000.

A useful paper on the **Precipitations of Dust** in the N.-E. Trades region of the North Atlantic, with an illustrative map, by Herr von Goerne, is published in *Globus* (No. 16, 1889).

A despatch from Sydney (9th May), states that H. M.'s cruiser *Rapid* has hoisted the British flag in the **Suwarrow Islands**, a small group in the Pacific, about 480 geographical miles NNW. of Cook Islands.

Under the auspices of the Bremen Geographical Society, Dr. Walther and Dr. Kükenthal propose this summer to make a voyage to the **Arctic Regions** on board a sealer, and to make a stay at either Spitzbergen or Novaia Zemlia.

Herr Paul Reichard contributes to the *Zeitschrift* (No. 139, 1889) of the Berlin Geographical Society an admirable and comprehensive article, with illustrations, dealing with the **Travelling Equipment** for a journey into East and Central Africa.

M. Thoroddsen contributes to *Geogr. Tidskrift*, No. 1, 1889, an account of his last journey into **Iceland**, containing valuable references to geological structure, volcanic activity and movements of glaciers, and some geographical and cartographical data.

The official *London Gazette*, of 30th November 1888, announces that the island of **Tobago** is henceforward separated from the British colony of the Windward Islands and united with that of Trinidad. The colony will henceforth be called "Trinidad and Tobago."

M. Chaffanjon, who has recently contributed to *Tour du Monde* a lengthy description of his journey to the sources of the Orinoko, is preparing for an expedition to the Goajiro peninsula and the neighbourhood of Lake Maracaybo. —*La Géographie*, 25th Nov. 1888.

The English Missionary Society, whose agents have been working for so long among the natives of **Tierra del Fuego**, is about to found a new station on the southernmost islands of the continent, in the Wollaston group, which cannot fail to be of importance to commerce and shipping. The mission is also to provide for the upkeep of a lighthouse.

The German barque *Oberon*, whilst on a voyage from Port Pirie to Falmouth, sighted, at midday, on 3d March 1887, in the Southern Pacific Ocean, an **Iceberg** 200 feet high. The *Oberon* at the time was in 51° 7′ S. lat. and 123° W. long. It was blowing a stiff breeze, with hail falling. The surface temperature of the sea was 7° C.—*Ann. der Hydrographie*, Heft 1, 1889.

The Fifty-ninth Annual Meeting of the **British Association for the Advancement of Science** will be held in Newcastle-on-Tyne, commencing 11th September next, with Professor William Henry Flower as President. The following are the officers of Section E (Geography) :—*President*, Colonel Sir Francis de Winton ; *Vice-Presidents*, General Sir H. E. L. Thuillier, R. Spence Watson; *Secretaries*, J. S. Keltie (*Recorder*), H. J. Mackinder, H. N. Sullivan, A. Silva White.

According to an announcement of the *Army and Navy Gazette* of 10th November 1888, the British corvette *Egeria* has obtained in the South Pacific Ocean two soundings which are deeper than any hitherto observed. The one, 4430 fathoms, with a bottom temperature of + 0·9°, was in 24° 37′ S. lat., and 175° 08′ W. long.; the other, 4295 fathoms, was 12 nautical miles farther south. The nearest sounding to these is that by the *Challenger* (1874) in 25° 5′ S. lat., and 172° 56′ W. long., which reached 2900 fathoms, with a bottom temperature of 0·5°. It would appear that the depth obtained by the *Egeria* belongs to the enclosed depressions of the East Indian Archipelago, and therefore it were desirable that more extended bathymetrical observations should be made in the neighbourhood of the Tonga Islands. The following, according to our present knowledge, are the greatest depths of the oceans, exclusive of the Polar Seas :—

North Pacific Ocean,	44° 55′ N., 152° 26′ E.,	8513 *m.* = 4655	fathoms.
South Pacific Ocean,	24° 37′ S., 175° — W.,	8101 *m.* = 4429·7	,,
North Atlantic Ocean,	19° 39′ N., 66° 26′ W.,	8341 *m.* = 4560·9	,,
South Atlantic Ocean,	0° 11′ S., 18° 15′ W.,	7370 *m.* = 4030	,,
Indian Ocean,	9° 18′ S., 105° 28′ E.,	5852 *m.* = 3199·9	,,

—*Petermann's Mitteilungen*, iii. 35, 1889.

NEW BOOKS.

Travels in the Atlas and Southern Morocco: A Narrative of Exploration. By Joseph Thomson, F.R.G.S. London: George Philip and Son, 1889. Pp. 484; Index, Maps, Illustrations. *Price* 9*s.*

In an earlier part of this volume of the *Magazine* we published Mr. Thomson's paper to the Society dealing with the geographical results of his recent journey to Marocco, of which the present volume is the personal narrative. We do not therefore require to remind our readers of the details of Mr. Thomson's explorations in the south-eastern extension of the Atlas Mountains. He was successful in exploring the lower ranges near Demnat, and, following in the footsteps of Foucauld, whose work he supplemented, he crossed the main range to Teluet. At four places, where he made ascents of the mountains, reaching on two occasions over 13,000 ft., or 2000 ft. higher than any of his predecessors, he struck new ground. Mr. Thomson, on his return, crossed the mountains into Sus, on which journey he formulated the opinion that the Atlas Mountains proper end some 20 miles from the Atlantic. The result of his explorations, which have been mapped, has been to supply new and reliable data of the configuration and physical features of the Atlas range.

Of all countries in Africa, Marocco is probably the most difficult to penetrate. This perhaps was an additional incentive to Mr. Thomson, who, in his previous expeditions into Africa, notably into Masai-land, had evinced an exceptional ability to overcome native hostility and obstruction, not by force of arms, but by patience, prudence, and courage. That the same abilities should characterise his leadership of an expedition into the dreaded regions of the Atlas Mountains was only to have been expected; but although they carried him beyond the limits of most of his predecessors, they were in places quite powerless to overcome the unexampled opposition of Moorish exclusiveness. Added to the ordinary difficulties of travel, the treachery of his men baulked him at every turn, and it was only by outwitting them and the native governors, with whom

they were often in league, that Mr. Thomson was ever able to penetrate those sealed districts of the mysterious Atlas, about which geographers are so anxious to obtain information. Our readers will remember his clever use of the Sultan's letter, which proved so invaluable to him. It was only by audacity such as this, and surprises of a similar character, that he was able to strike into the unknown parts of the empire with which his narrative deals. It is scarcely necessary to add that the incidents of travel and his personal experiences are recorded in his familiar style.

Mr. Thomson has the usual story to tell of the paralysing influence of Moorish misgovernment, and the shameful results of the "protection" policy of European and American diplomatic agencies. He says:—"Such is the blighting influence which Moorish misgovernment is everywhere casting over these brave, industrious mountaineers. Up every glen this huge, blood-sucking octopus is pushing its horrible feelers, instinct with the lust of power, dragging village after village from its contented and independent isolation to feed with its life-blood the rapacious appetite of this bloated monster. In some places the old independence is still maintained, and there, though almost starved into submission, the Shellach fight desperately for home and freedom" (p. 228). If this is the case in the less accessible mountain districts, we can imagine what it must be in the plains. Mr. Thomson says:—"The Moorish principles of ruling may be summed up in two words—poverty and disunion. Keep the people ground down to the dust and foster tribal animosities, and there will be no rising against the constituted authority. In the poverty of his subjects and the disunion of the tribes lies the strength of the Sultan" (p. 437). Very picturesquely and forcibly he describes the actual state of affairs when he says:—"The Sheiks drain the people, the Kaids the Sheiks, and the Sultan the Kaids, the result being as complete as the drainage of a given area into the ocean by a river and its tributaries" (p. 438). This is a state of affairs with which we are only too painfully familiar. Of the position of the Jews, whose unique lot is so often commiserated, Mr. Thomson tells a new story: he says that, among the mountains and south of the Atlas, their lot is as much deserving our commiseration as ever, but in the towns and in Marocco proper it is far better than that of the Faithful. "In the Jews," he says, "we have a people alien, despised and hated, actually living in the country under immeasurably better conditions than the dominant race, while they suck, and are assisted to suck, the very life-blood of their hosts."

The publishers of Mr. Thomson's book have set a good example by producing such a richly illustrated volume at so moderate a price. The numerous illustrations are well executed, and two good maps (a physical and a geological) accompany the volume.

Garenganzé; or Seven Years' Pioneer Mission Work in Central Africa. By Fred. J. Arnot. London: James E. Hawkins. 1889. Pp. 274. *Price* 2*s.* 6*d.*

Mr. Arnot, like his prototype, Dr. Livingstone, shows us how Africa can be entered and explored by a single individual, whose chief protection against native opposition are his own purity of motive and singleness of purpose. Where large and well-armed caravans, equipped at enormous expense by Geographical Societies and others, have failed to penetrate certain districts of Africa, and have returned with a modicum of geographical information, a single individual, unarmed and undaunted, has occasionally succeeded in entering the Unknown, and has emerged with geographical discoveries of the highest importance. Mr.

Arnot's remarkable career in Africa is a case in point. For seven years he wandered through Africa, making lengthy stays in the Barotse valley and in the Garenganzé country. He crossed the continent from Natal to Benguela, from whence he eventually reached Msidi's capital in Garenganzé. On the way he passed through some country (*e.g.* from Peho to Garenganzé) previously unknown to us, which he roughly mapped.[1] He has made known the Garenganzé country—the Katanga of the Arabs—and has helped to unravel the hydrographic problems in the interesting country where the Lualaba, Lufira, and Zambesi rivers take their rise—a district which he has identified with Livingstone's "three fountains;" and he has apparently proved that Livingstone's "Leeba" is the Zambesi itself, and not the river which flows out of Lake Dilolo. The hill which he names "Border Craig" indicates, he believes, one of the earliest sources of the Zambesi and Congo rivers. This would make the southern boundary of the Congo Independent State to include the large kingdom of Garenganzé. Mr. Arnot's modest narrative, which has been hastily put together from the letters he wrote home at the time, and other memoranda, abounds in incident: the perils and privations of his journeys and long residences among savage people, the danger from wild animals, the troubles with his porters, and his own frequent ill-health. One cannot fail to admire the courage, endurance, and devotion which carried him through so many dangers and difficulties. Now that he has returned to the scene of his labours we can confidently look forward to even more important results, both from the geographical and the missionary points of view.

A few references to Mr. Arnot's book may be added. It is gratifying to read his eulogy of the "noble chief" Kama and his people. Mr. Arnot appears to be "the first Scotchman and the second British subject" who has gone beyond Shesheke since Livingstone's visit. His original idea was to reach the Batoka, on the high land to the north of the Zambesi; but he reluctantly abandoned his purpose, and, instead, was forced to make a stay of some two years at the capital of the Barotse kingdom. An account of the Garenganzé kingdom and people concludes the book, which, it should be mentioned, is edited by Mr. Henry Groves and Dr. J. L. Maclean.

The Diary of William Hedges, Esq. (afterwards Sir Wm. Hedges) during his agency in Bengal, as well as on his voyage out and return overland (1681-1687). Illustrated by Colonel Henry Yule, R.E., C.B., LL.D., President of the Hakluyt Society. Three vols., with portraits and illustrations. London, 1887-89.

The Hakluyt Society has been the most attractive and useful handmaid of Geography, having given to the world some eighty volumes of rare or unpublished voyages and travels which otherwise could not have seen the light. This *Diary* has proved one of the most valuable of these, as enriched by the wealth of learning and illustration which leads Colonel Yule to adorn all he touches. Sir William Hedges was sent out by the Court of Directors to make their Bengal factory independent of Madras, at the time when the famous Job Charnock founded Calcutta, 1681-1684. This *Diary* forms a contemporary picture of life in Bengal at that early period, and of his return home by the Persian Gulf, Lar, Ispahan, Bagdad, Mosul, Diarbekir, Aleppo, Iscandroon, Tunis, Sardinia, Toulon, Paris, and Calais, to Dover. All this occupies the first volume, and is

[1] Mr. Arnot's paper to the Royal Geographical Society of London was illustrated by a map in the Society's *Proceedings* for February last, a copy of which is given with his book.

indispensable to the student of the early history of British India. The second and third volumes abound with the most charming biographical and other illustrations of the *Diary* from the pen of Colonel Yule, who made a wide and protracted search of the Indian Office records. We now know Job Charnock, Streynsham Master, Governor Pitt, and Josiah Child as we never knew them before, and we have rare portraits of these worthies reproduced. The episode of the Pitt Diamond is told with fulness and accuracy, and in a style which gives the third volume the interest of a good novel. The closing pages are devoted to precious details regarding the early charts and topography of the Hugli River, one of which is given—viz., John Thornton's "Mapp of the Greate River Ganges as it emptieth itself into the Bay of Bengala," which appeared in the 1675 edition of the *English Pilot*. To the geographer and historian these are priceless volumes.

Geographía de la República Argentina. Par F. Latzina. Buenos Ayres: Félix Lajouane, 1888. Pp. xii. + 758.

The aim of the writer of this book has been to compile a compendium of the geography of the Argentine Republic which shall be suitable for use not only as a school text-book, but also at the same time as a statistical work of reference. We cannot say that the attempt has been a success. In the first place, the two aims are not readily congruent. Our perusal of all the *facts*, carefully and industriously gathered together in the present book, has only convinced us that the materials for a scientific geographical account of the Republic are not yet either collected in sufficient quantity and with sufficient certitude, or sufficiently digested, to allow of a completely satisfactory didactic text-book being written. But our main quarrel is with the author's conception, or rather execution, of the task he has set himself. His book is neither a scientific geography, nor a gazetteer, nor an emigrant's guide-book, nor yet a statistical lexicon, but embraces elements of all four, and in the chapter devoted to the city of Buenos Ayres we have several pages that would be more in place in the city post-office directory. In substantiation of this criticism we venture to say that in our opinion one can scarcely count as geography such things as pavement statistics (length of streets in each different kind of paving); the number of public gas-lamps and the cost of putting them up (pp. 190-191); the tramway fares, with the number of horses and men employed (pp. 193-95); the administrative divisions of the various local authorities having jurisdiction in the city (p. 202); the number of performances given in the year at the theatres, and the number of persons attending them (p. 210); the number of places appropriated to the prosecution of trades and professions, or the number of barbers' shops, hotels, carpenters' shops, etc. (pp. 212-14). Outside of the city we find similar facts recorded, though not indeed to the same extent. The number of houses built and building, etc., in the town of La Plata (p. 238); the prices of land sold in the province of Buenos Ayres (p. 224); and the number of locomotives, railway wagons, etc., in use on the railroads of the Republic, are certainly not pertinent to the science of geography, and still less pertinent in a geographical work intended to be used in schools. We should also have liked the book all the better if it had *not* contained the chapter on cosmography. These adverse remarks were challenged by the author's preface, in which he formally discusses some of the principles of geographical method. Having expressed our dissent from his interpretation in practice of his own formal laws on the subject, we can turn to what there is to praise in the book. And there are, indeed, several things to be spoken of with commendation, such as the chapter on geographical definitions (though we have failed to detect the

logical principles of its arrangement), the description of the physical features of the country, the detailed accounts of the principal provinces, and the number of very useful tables scattered through the pages (such as latitude and longitude of numerous places, at p. 10; differences of time between various towns, at p. 12; altitude of towns, at p. 81; passes over the Andes, at p. 54; several climatic tables, at pp. 142-157; railway distances, at p. 292, etc. etc.). On the whole the book is a compilation of the geography and statistics of the Republic that should be very serviceable for consultation, though it is scarcely adapted for use as a school-book, except perhaps in the hands of teachers. The maps also are a decidedly useful feature, for they include not only a good general map, but also maps, equally good, of the chief provinces. Nor are we ungrateful for the three lengthy appendices, on the nomenclature of Argentine geography, Argentine chronology, and the list of industrial and medicinal plants, respectively. The printers' and bookbinders' work is likewise in every way commendable.

The England of Shakespeare. By EDWIN GOADBY. Pp. xii. and 224. London: Cassell and Co., Limited, 1889.

In this unpretentious volume Mr. Goadby gives a brief description of the state of England in the reign of Queen Elizabeth, with the object of showing how the genius of Shakespeare was affected by his environment. An exhaustive treatment of the subject is not attempted, but enough is said of the characteristic features of the time to arouse fresh interest in tracing the rapid strides that have been made in the development of trade and commerce, as well as in science, during the succeeding centuries. The description of Old London given in Chapter IX. is specially interesting, recalling associations connected with some of the peculiar city-names with which we are so familiar. There are a number of illustrations, that on page 209 furnishing a curious specimen of cartography.

NEW MAPS.

EUROPE.

MAKEDONIEN UND ALT-SERBIEN, Ethnographische Karte von ——. Von Spiridion Gopčevič. Massstab, 1 : 750,000.

Petermann's Mitteilungen, Jahrgang 1889, *Tafel* 4.

ZUIDERZEE, Entwurfe zur Trockenlegung der ——, in Holland. Von P. A. van Buuren. *Deutsche Geographische Blätter, Jahrgang* 1889, *Tafel* 1.

ITALIA, Carta Altimetrica e Batometrica dell' ——, construtta e disegnata da Guido Cora. Scale, 1 : 2,000,000.

Cosmos II° Suplemento. Torino: Guido Cora.

ASIA.

CENTRAL-ASIEN, Uebersichtskarte von General N. M. Przewalsskij's Reisen in ——, 1871-73; 1876-77; 1879-80; und 1884-85. Nach den russischen Originalkarten und mit Berücksichtigung der Reisen von Regel, Younghusband, Carey, Michaelis und Anderen gezeichnet von Carl Schmidt. Massstab. 1 : 4,500,000. *Petermann's Mitteilungen, Jahrgang* 1889, *Tafel* 2. *Gotha: Justus Perthes.*

JUBBULPORE DISTRICT, INDIA, Geological Map of a portion of the ——. Scale, 1 : 63,360. *Records of the Geological Survey of India, November* 1888.

THE CHINDWIN RIVER, UPPER BURMA, reduced from the Surveys of Col. R. C. Woodthorpe, R.E., C.B. ; Captain J. R. Hobday, S.C. ; and Captain E. W. Dun. Scale, 1 :1,020,000. *Proceedings of the Royal Geographical Society, April* 1889.

AFRICA.

L'ÉTAT INDÉPENDANT DU CONGO, Carte de ——, dressée par A. J. Wauters. Echelle, 1 : 7,000,000. Institut National de Géographie, Bruxelles.

Notice sur l'Etat Indépendant du Congo, par H. Droogmans. Bruxelles : Imprimerie van Campenhout frères et sœur. Février 1889.

USAMBARA, Provisorische Kartenskizze von ——. Von Dr. Oscar Baumann, Mitglied der Meyerschen Expedition nach Ost-Afrika. Massstab, 1 : 800,000. *Petermann's Mitteilungen, Jahrgang* 1889, *Tafel* 3. *Gotha : Justus Perthes.*

CENTRAL-ZAMBEZI REGION, Maps of Mr. F. C. Selous's Routes in the ——, 1888. Constructed from his sketch-maps, collated with the work of other travellers, by W. J. Turner. Scale, 1 : 2,500,000.

Proceedings of the Royal Geographical Society, April 1889.

KANO, SOKOTO, UND GANDU, Route von Paul Staudinger und Ernst Hatert von Loko am Binuë nach ——, 1885-86. Von Wilhelm Erman. Massstab, 1 : 1,000,000. *Im Herzen der Haussa-Lander, von Paul Staudinger. Adolf Landsberger, Berlin*, 1889.

OST-AFRIKA, Handkarte der deutschen Schutzgebiete in ——. Massstab, 1 : 1,000,000. Redig. von J. J. Kettler. *Weimar : Geographisches Institut.*

NORTH AMERICA.

SELKIRK RANGE, BRITISH COLUMBIA, Part of the ——. From a Survey by Rev. W. S. Green, M.A. Scale 1 : 126,720.

Proceedings of the Royal Geographical Society, March 1889.

SOUTH AMERICA.

RIO GRANDE DO SUL, BRAZIL, Die italienischen Kolonien in——. Conde d'Eu, Dona Isabel Alfredo Chaves und Caxias. Nach den Aufnahmen der Ingenieure J. da Silva Oliveira und M. Barata Goes von Paul Langhans. Massstab, 1 : 160,000.

RIO GRANDE DO SUL, BRAZIL, Die italienischen Kolonien in——. Silveira Martins, nach José M. S. Couto ; Macel, Affonso Penna, etc., nach L. Wertheimer von Paul Langhans. Massstab, 1 : 160,000.

Mitteilungen der Kais. Königl. Geographischen Gesellschaft in Wien, 1889. *Tafel I. und II.*

RIO GRANDE DO SUL, Die Südbahn in ——. Von Paul Langhans. Massstab, 1 : 1,000,000. *Deutsche Geographische Blätter, Jahrgang* 1889. *Tafel* 2.

NEW ATLASES.

Longman's New Atlas, Political and Physical. Engraved and lithographed by Edward Stanford. Edited by George G. Chisholm, M.A., B.Sc. London : Longmans, Green and Co., 1889. *Price* 12*s.* 6*d.*

This is the best atlas for school purposes yet published in Britain. There are forty quarto and sixteen octavo maps printed in colours ; sixteen quarto plates of characteristic scenery and types of mankind, and an index in which the latitude and longitude of each place named are given, and many places which are not named on the maps are included for reference. Mr. Chisholm, in his preface, acknowledges assistance from many authorities in preparing his work, which reflects great credit on his powers of selection, compilation, and

editing. The maps are coloured tastefully in a subdued green tint for all land under 1000 feet in elevation, and a light brown above that height, the sea-depths being similarly distinguished in shades of blue above and below the 100-fathom line. The maps of the British Islands, which are more detailed, are not so successful in colouring, and that of Germany is spoilt altogether by attempting too much. Political boundaries are marked by red lines, showing very clearly their relation to configuration. The limits of navigation and the cataracts or rapids on rivers are distintly shown. The names are wisely restricted in number, and the selection appears to us judicious. The projection used is mentioned on each map, and the scales employed are few and simply related to each other. The British Islands are shown on the scale of 1 : 2,000,000 ; the smaller European countries are treated in equal detail ; most of the larger are on the scale of 1 : 4,000,000 ; and the continents, 1 : 40,000,000. Many of the insets are of special utility, and the plates of views, etc., at the end are admirable. Messrs. Longmans deserve special praise in taking the initiative in producing a style of atlas familiar in Germany, but hitherto, unfortunately, not adopted in Britain ; they are to be congratulated also on the services of so sound a geographer and so able an editor as Mr. Chisholm. Improvements are, of course, possible, and will doubtless be introduced in subsequent editions.

BERLINER SCHUL-ATLAS, Herausgegeben von Richard Andree und Richard Schillmann. Ausgeführt von der Geographischen Anstalt von Velhagen und Klasing in Leipzig.

Berlin, C. 1889. *Verlag der Stubenrauchschen Buchhandelung. M.*1.

Richard Andree has prepared, in collaboration with Richard Schillmann of Berlin, an entirely new edition of *Andree's Schul-Atlas*. With the addition of maps of the Province Brandenburg, Berlin and environs, and a school map of the City of Berlin, this new edition is specially issued for use in Berlin schools. All the maps are very well executed. The Atlas, which contains 38 pages, is probably the cheapest ever published.

LONDON, Pocket Atlas and Guide to ——, by J. G. Bartholomew, F.R.G.S., etc., containing 16 Maps, with statistical information and index.

Limp cloth, Price 1*s.*

PARIS, Pocket Atlas and Guide to ——, by J. G. Bartholomew, F.R.G.S., etc., containing 16 Maps, with statistical information and index.

London : John Walker and Son. Limp cloth, Price 1*s.*

Designed for the use of tourists. The large-scale section maps show the streets, buildings, tramways, railways, etc. The descriptive letterpress and index will be found useful.

SCHWEIZ, Topographischer Atlas der ——, im Massstab der original Aufnahmen nach dem Bundesgesetze vom 18 December 1868, durch das eidgen. topogr. Bureau gemäss der Directionen von Oberst Siegfried veröffentlicht 32 Lieferung ; No. 81, Bauriet ; 82, Reinegg ; 187, Hochdorf ; 203, Emmen ; 206, Küssnach ; 207, Arth ; 239, Rütli ; 360, Riaz ; 361, Berra ; 362, Bulle ; 426, Savognin ; 497, Brig.

UNITED STATES : Geological Survey. T. W. Powell.

Texas : Meridian ; Hamilton ; Coleman : Brownwood. South-Carolina : Pickens. Alabama : Cullman ; Gadsden ; Anniton. Massachusetts : Lawrence. West-Virginia : Franklin ; Woodstock ; Harper's Ferry. Georgia : Dalton ; Ellijay. Virginia : Gordonsville ; Luray. Tennessee : Chattanooga. Missouri : Lexington. Kansas : Burlington ; Atchison ; Sedan ; Seneca ; Burlingame ; Parkerville ; Junction City ; Topeka ; Cottonwood Falls ; Lawrence ; Burden ; Wamego ; Marrysville.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

A NOTE ON SOME ASTRONOMICAL OBSERVATIONS TAKEN UPON A JOURNEY FROM QUILLIMANE TO THE NORTH EXTREMITY OF LAKE NYASSA.

By Henry E. O'Neill,

Gold Medallist R.G.S. London, and Hon. Corr. Mem. of R. Scottish and Manchester Geographical Societies.

The chief object of the observations taken by me upon the journey to Lake Nyassa, which I carried out last year, was to test the longitude of that lake as laid down by the late James Stewart, C.E., and to make certain corrections that I felt were wanting in the course of the Shiré, Lower Zambezi, and Qua-qua rivers—in short, along the whole line of eastern water route from Quillimane to the first of the Central African lakes.

That the longitude of the western shore of Lake Nyassa given by Mr. Stewart was not quite correct I had been led to believe, from the discovery that the base used by him for the correction of his chronometers for error upon Greenwich mean time was incorrectly placed. That base was Blantyre upon the Shiré Highlands, the position of which was changed from long. 34° 56′ 30″ E. to long. 35° 3′ 54″ E. by a decision of the Council of the R.G.S. of London in 1885,[1] in accordance with the results of a long series of observations made by me there in 1884. If

[1] See *Proceedings R.G.S.*, August 1885, p. 538.

we assume the rates of the chronometers used by Stewart, M'Ewan, and others, on and around Lake Nyassa, to have been carefully and accurately fixed, then we may venture to conclude that all the results of the longitude observations taken by them must be shifted, equally with the base, 7′ 24″ to the eastward. Our great African cartographer, Mr. Ravenstein, has, I see, adopted this view, and in a map recently drawn by him for Mr. James Stevenson, and presented to the Royal Scottish Geographical Society, he has changed all Stewart's and M'Ewan's positions by exactly the distance Blantyre was changed by me in 1884.

The present observations will serve to show that, as far as the lake positions are concerned, the change made is practically correct. The observations by chronometer—which was corrected at Quillimane for error on Greenwich mean time—bear out as closely, I think I may say, as observations of this class can do (the nature of the journey, time occupied, and climate and country passed through being considered), the observations for longitude by lunar distances taken in 1884. The result of the first taken placed Blantyre in 35° 3′ 54″ E.; the result of the second—a perfectly different and independent class of observations—places it in 35° 2′ 26″ E. Surveyors and observers for longitude of points in unsurveyed and primitive countries, far distant from known points fixed by electricity from Greenwich, will appreciate, without explanation, the smallness of this difference.

The general results of these observations, and of those taken by me on Lake Nyassa, were made public in a paper read before the Manchester Geographical Society a short time before Mr. Ravenstein published his late map. I am very pleased that they should so closely coincide with the changes made by him.

Upon the Lower Shiré, Zambezi, and Qua-qua rivers, the observations taken by me, and changes of position made, are—(1) at the point of confluence of the Mutu and Qua-qua rivers; (2) at Vicenti, the starting-point on the Zambezi for the Nyassa districts; (3) at Shupanga, on the south bank, the site of a Portuguese military post, and historically interesting to all Britons as the last resting-place of Mrs. Livingstone; (4) at Morambala Mountain, the only grandly conspicuous natural feature passed on the voyage from Quillimane to the Shiré Highlands; and (5) at Katunga, the landing-place below the Shiré cataracts for travellers to the Shiré Highlands and lake districts. To fix the longitude of Lake Nyassa, observations were taken (6) at the south extremity, at Livingstonia upon Cape Maclear; (7) at Karonga, nearly at the north end of the lake; and (8) at Bandawe, upon the western shore midway between these two points.

Perhaps it will be best if I take these places in detail, and show the changes made, first describing the instruments used.

But before doing this, I desire to say that another object I had upon this journey was to put to the test of actual trial a point regarding which travellers in unknown quarters of the globe who are anxious to do reliable surveying work will be strongly interested. The question has often been debated, and is still in dispute, as to whether chronometers are to be relied upon for inland journeys. The Royal Geographical Society of London, judging by the experience of most of their African travellers, have decided in the negative, and have ceased to supply their travellers with chronometers, preferring to give them what is called the "half-chronometer." In that most valuable work, *Hints to Travellers*, published under the direction of the Society, intending travellers are warned against chronometers, which are said to have only proved reliable under exceptionally favourable circumstances and in skilled hands.

So strong an opinion on the part of such high authority has naturally caused a fear of and prejudice against these instruments, and I believe very few travellers, at all events in Africa, have ventured lately to carry them. During my last furlough in England in 1885, I found that most of the instrument-makers with whom I spoke did not share this opinion, and therefore, although in all my previous journeys I had used "half-chronometers," I determined on my next to take with me a chronometer, give it the chief burden of the work, and try the results.

I think any one who looks into the accompanying observations will find reason to be satisfied with the behaviour of the chronometer used, and may reasonably conclude that a good chronometer-watch, supplied by a first-rate maker, will, if properly treated and carefully rated—conditions necessary with both descriptions of instruments—give longitude results satisfactory to himself and geographers in general. I had also with me a good "half-chronometer watch," by Lund and Blockley of London, which I owe to the kindness of the Royal Geographical Society of London, but its place was only that of a "stand-by," and all the observations taken were dependent on the Greenwich mean time shown by Frodsham's chronometer—called *A.* chronometer in the accompanying observations.

It is now only necessary for me to say a few words respecting the manner in which I have applied the rates, obtained at different times by observations, to *A.* Chronometer. Series of observations for rating this chronometer were taken:—(1) at Mozambique; (2) at Vicenti, on the Zambezi; (3) at Mandala, on the Shiré Highlands; and (4) at Karonga, North Nyassa. Had not the incidents, now well known, brought about by the Arab attack on Karonga interfered with my observing work, I should, of course, have continued rating *A.* chronometer until my return to the coast; but those events made it impossible, and my observations ceased to be regularly taken on the 15th of November 1887.

The observations taken for rating are all shown, with those taken for longitude, in the following tables, so that any one may judge their accuracy. What I have to say a word about is the manner in which I have applied those rates. The rule I have followed is this :—Suppose the rates found at the above-mentioned places to be represented by A, B, C, and D. Then the rate applied on journey between A and B will be the mean of rates A and B: the rate applied between points B and C will be the mean of rates B and C, and so on. This plan has appeared to me better than that of applying the rate obtained at A until arrival at B, the rate obtained at B until arrival at C, and so onwards. The latter plan, though more commonly pursued, assumes a sudden change in the chronometer rate, which is most improbable; the plan I have followed provides a succession of mean rates, obtained at short intervals of time, which ensure, I think, a greater accuracy of result.

Instruments used in the following Observations.

One 2-day chronometer, No. 07224, by Charles Frodsham, 84 Strand, London.
One half-chronometer watch, No. $\frac{2}{9}\frac{2}{7}\frac{3}{9}$, by Lund and Blockley, London.
An 8-inch radius sextant, by Casella, London.
A 6-inch do., by Crichton and Whitbread, London.
An artificial horizon, with reservoir underneath trough, by Casella, London.

Note.—The following observations have all been submitted to Dr. Gill, the Astronomer-Royal at the Cape of Good Hope; and in his letter (dated 13th March last), returning them to me, Dr. Gill makes the following remarks :—

"The results are extremely creditable, and appear to me, as a whole, to be thoroughly sound; and, indeed, amongst the best that have been obtained with similar opportunities. . . . The coincidence in the longitudes of Blantyre, obtained by you in 1884 and 1887, is quite wonderful, and, indeed, to some extent, must have been favoured by chance. Your chronometer appears to have behaved remarkably well—astonishingly so—although it had a small change of rate in leaving Mozambique. . . ."

This very satisfactory report, from so high an authority as the Astronomer-Royal at the Cape, enables me to put forward these observations with all the more confidence in their reliability.

TABLE OF OBSERVATIONS TAKEN UPON JOURNEY FROM MOZAMBIQUE TO NORTH EXTREMITY OF LAKE NYASSA, AUGUST 1887 to FEBRUARY 1888.

By HENRY E. O'NEILL, late H.M. Consul for Portuguese East African Possessions.

TO FIND DAILY RATE OF CHRONOMETER *A*.

Place, Date, and Body observed.	Times of Chron.	Apparent Alts.	Errors on Mean Time at Place.	Mean of Errors on M. T. P.	Remarks.
H.M. Consulate, Mozambique.	H. M. S.	° ′ ″	H. M. S.	H. M. S.	
	5 18 6·8	24 37 51	2 40 4·5		
	5 21 22·5	25 22 18	2 40 3·8	2 40 3·84 Slow.	Rate of *A*. Chron. by Obs. on 28th August and 11th September = sec. 0·256 loss daily.
Lat. 15° 2′ 0″ S.	5 23 57·0	25 57 36	2 40 4·2		
Long. 40° 45′ 6″ E.	5 26 29·3	26 32 8	2 40 3·5		
August 28, 1887.	5 27 14·0	26 42 13	2 40 3·2		Rate of *A*. Chron. by Obs. on 30th August and 13th September = sec. 0·236 loss daily.
A.M. ☉					
Do. Do.	5 11 51·0	23 35 0	2 40 3·8		Taking mean of above Rates.
August 30, 1887.	5 14 18·7	24 8 48	2 40 2·5	2 40 3·95 Slow.	Rate of *A*. Chron. between 28th August and 13th September 1887, will be sec. 0·246 loss daily.
A.M.	5 16 58·8	24 45 53	2 40 3·8		
	5 20 14·8	25 31 12	2 40 5·7		
Do. Do.	4 59 47·3	23 12 20	2 40 7·9		
September 11, 1887.	5 6 22·5	24 45 13	2 40 7·1	2 40 7·43 Slow.	
A.M. ☉	5 9 44·7	25 32 40	2 40 7·3		
Do. Do.	4 58 42·2	23 21 5	2 40 7·3		
September 13, 1887.	5 1 39·5	24 3 3	2 40 7·3	2 40 7·25 Slow.	
A.M. ☉	5 4 49·2	24 47 54	2 40 7·2		
	5 10 53·0	26 13 41	2 40 7·2		

TABLE OF OBSERVATIONS (*continued*).

TO FIND DAILY RATE OF CHRONOMETER *A*.

Place, Date, and Body observed.	Times of Chron.	Apparent Alts.	Errors on Mean Time at Place.	Mean of Errors on M. T. P.	Remarks.
Vicenti, African Lakes Co.'s Station, North Bank of Riv. Zambezi.	H. M. S.	° ′ ″	H. M. S.	H. M. S.	Rate of *A*. Chron. by P.M. Obs. ☉ on 30th September and 4th October = sec. 0·46 gain daily.
	1 43 52·7	25 50 39	2 19 56·3	2 19 57·05	
	1 47 20·3	25 1 21	2 19 57·8	Slow.	
					At Mozambique Obs. for Rate showed a loss per day of sec. 0·25.
Lat. 18° 1′ 47″ S. Long. 35° 41′ 20″ E. September 30, 1887. P.M. ☉	...	...		...	∴ Rate to be applied between 13th September and 30th September will be sec. 0·105 gain daily.
Do. Do. October 4, 1887. P.M. ☉	1 2 32·5	35 48 11	2 19 54·1	2 19 55·2 Slow.	
	1 7 55·0	34 32 9	2 19 54·7		
	1 11 32·2	33 40 34	2 19 56·0		
	1 16 49·8	32 25 39	2 19 56·2		
Mandala, Shiré Highlands.					
Lat. 15° 47′ 25″ S. Long. 35° 1′ 46″ E. October 18, 1887. A.M. ☉	4 58 17·2	23 52 5	2 17 5·3	2 17 5·55 Slow.	Rate by A.M. Obs. ☉ on 18th and 23d October = sec. 0·45 gain per day.
	5 1 38·0	24 40 25	2 17 5·8		
Do. Do. October 23, 1887. A.M. ☉	5 6 53·	26 30 50	2 17 3·5	2 17 3·25 Slow.	
	5 10 8·7	27 17 33	2 17 3·0		

TABLE OF OBSERVATIONS (*continued*).

TO FIND DAILY RATE OF CHRONOMETER *A*.

Place, Date, and Body observed.	Times of Chron.	Apparent Alts.	Errors on Mean Time at Place.	Mean of Errors on M. T. P.	Remarks.
	H. M. S.	° ′ ″	H. M. S.	H. M. S.	
Mandala.	1 51 46·5	25 20 50	2 17 12·5	2 17 12·57 Slow.	
October 17, 1887.	1 55 53·0	24 21 34	2 17 12·5		
P.M. ☉	1 58 57·3	23 37 21	2 17 12·7		Rate by P.M. Obs. ☉ on 17th and 23d October = sec. 0·323 gain per day.
Do. Do.	2 5 40·0	22 15 39	2 17 10·6	2 17 10·63 Slow.	
October 23, 1887.	2 9 43·3	21 17 39	2 17 10·9		
P.M. ☉	2 12 35·0	20 36 47	2 17 10·4		
Mandala.	4 38 0·7	29 1 28	2 17 12·8	2 17 12·8 Slow.	Rate by Obs. of ✳ Antares West on 18th and 23d October = sec. 0·54 gain per day.
October 18, 1887.	4 45 26·3	27 21 40	2 17 12·7		Mean of Rates by Obs. taken at Mandala of ☉ A.M., ☉ P.M., and ✳ Antares West = sec. 0·437 gain per day.
✳ Antares, West.	4 49 16·8	26 30 1	2 17 12·9		At Vicenti, Obs. for Rate showed a gain per day of sec. 0·46.
October 23, 1887.	4 32 13·2	25 55 57	2 17 9·6	2 17 10·1 Slow.	∴ Rate to be applied to *A*. Chron. between 30th September and 17th October 1887 = sec. 0·449 gain per day.
✳ Antares, West of Meridian.	4 45 7·3	23 2 51	2 17 10·6		
Karonga, N.W. Shore of Lake Nyassa.					
Lat. 9° 57′ 0″ S. Long. 33° 58′ 25″ E.					
November 6, 1887.	2 41 54·3	28 33 49	2 12 47·3	2 12 46·87 Slow.	Rate by Obs. of Planet Venus E., on 6th and 15th November = sec. 0·493 gain per day.
Planet Venus, East	2 46 36·3	29 42 51	2 12 46·3		Rate by Mean of all Obs. taken at Mandala = sec. 0·437 gain per day.
of Meridian.	2 51 4·5	30 48 44	2 12 47·		∴ Rate to be applied to *A*. Chron. between 17th Oct. and 6th November 1887 = sec. 0·465 gain per day.
November 15, 1887.	2 29 22·	27 41 58	2 12 42·4	2 12 42·43 Slow.	
Planet Venus, East	2 33 30·	28 43 1	2 12 42·7		
of Meridian.	2 39 24·5	30 10 2	2 12 42·2		

TO FIND ERROR ON GREENWICH MEAN TIME OF *A.* CHRONOMETER AT QUILLIMANE

BEFORE STARTING FOR THE INTERIOR.

Position of the British Vice-Consulate as deduced from the Observations of Mr. FINLAY, F.R.A.S., of the Cape Observatory, taken at the Custom House, Quillimane, in 1882. } Lat. 17° 51′ 44″ S. Long. 36° 52′ 15″ E.

Date and Heavenly Body observed.	Times by Chronometer.			Apparent Altitudes.			Errors on G.M.T.			Mean of Errors on G.M.T.			Remarks.
	H.	M.	S.	°	′	″		M.	S.		M.	S.	
A.M. 22d September 1887. ☉ East of Meridian.	5	7	2·5	23	4	4	Fast	2	49	Fast	2	49	Weather cloudy. Only one set of three observations obtainable on the morning of September 22d.
A.M. 23d September.	0	16	45·2	34	41	32	Fast	2	46·7				Morning of 23d misty, with heavy dew.
✳ Sirius, East of Meridian.	0	22	17·0	35	59	46	,,	2	47·4	Fast	2	46·93	Only one set of five observations obtained of ✳ Algenib.
	0	27	39·0	37	15	56	,,	2	46·7				
A.M. 23d September. ✳ Algenib, West of Meridian.	0	49	46·5	32	26	25	Fast	2	56·1	Fast	2	56·1	No observations of ☉ could be got on morning of 23d Sept., but by applying Rate to Error on G.M.T., obtained from A.M. observations of ☉ on 22d, we have Error at A.M. on 23d M. S. Fast 2 49·1 And Error on G.M.T. by observations of ☉ at P.M. of 23d was M. S. Fast 2 44·5
P.M. 23d September.	1	33	2·7	26	56	15	Fast	2	44·3				∴ Error at Noon of 23d by observations of ☉ East and West of Meridian
☉ West of Meridian.	1	35	44·7	26	18	23	,,	2	44·8	Fast	2	44·5	
	1	38	44·7	25	36	1	,,	2	44·4				M. S. = Fast 2 46·8 And Error on G.M.T. on 23d by ✳s East and West of Meridian was M. S. Fast 2 51·5 ∴ Error of *A.* Chron. on G.M.T. at Noon of 23d Sept. M. S. = Fast 2 49·15

TABLE OF LONGITUDES.

Date and Place of Observation.	Heavenly Body observed.	Times by Chronometer.	Apparent Altitudes.	Longitudes.	Mean Longitude by Bodies East and West of Meridian.	Remarks.
		H. M. S.	° ′ ″	° ′ ″	° ′ ″	
A.M. 26th Sept. 1887.	☉ East of	5 13 10·2	24 36 50	36 6 39 E.		
Mambusha, near junction of Mutu and Qua-qua rivers.	Meridian.	5 17 24·7	25 36 48	36 6 37 E.		
		5 21 23·2	26 32 43	36 6 7 E.		
					36 7 38 E.	Lat. by ✳s N. and S. of Zenith, 18° 2′ 0″ S.
Mambusha.	☉ West of	1 51 7·8	23 30 46	36 8 51 E.		
P.M. 26th Sept.	Meridian.	1 57 10·5	22 5 28	36 8 36 E.		
		2 0 24·3	21 19 31	36 8 57 E.		
A.M. 30th Sept. 1887.	☉ East of	5 26 3·8	28 4 46	35 41 6 E.		
Vicenti. African Lakes Company's Station, north bank of Zambezi river.	Meridian.	5 28 43·8	28 42 26	35 40 57 E.		
		5 31 21·7	29 19 32	35 40 48 E.		
					35 41 20·5 E.	Lat. by ✳s N. and S. of Zenith, 18 1 47 S.
Vicenti.	☉ West of	1 43 52·7	25 50 39	35 41 33 E.		
P.M. 30th Sept.	Meridian.	1 47 20·3	25 1 21	35 41 55 E.		
P.M. 1st Oct. 1887.	☉ West of	1 58 33·0	21 25 15	35 37 22 E.		In observations at Shupanga *B.* Chronometer-watch was used. Correction of *B.* upon *A.* Chronometer being, in case of ☉ observations + 4′ 31·5″, and in case of ☾ observations + 4′ 32″.
Shupanga, South bank of Zambezi river.	Meridian.	2 1 1·5	20 50 0	35 37 33 E.		
		2 3 18·2	20 17 36	35 37 28 E.		
Portuguese Fort.					35 36 59 E.	
Shupanga.	☾ East of	5 29 23·5	31 38 6	35 36 24 E.		Lat. Shupanga by ✳s N. and S. of Zenith, . . . 18° 1′ 38″ S.
P.M. 1st Oct.	Meridian.	5 32 21·0	32 18 46	35 36 37 E.		

TABLE OF LONGITUDES (*continued*).

Date and Place of Observation.	Heavenly Body observed.	Times by Chronometer.	Apparent Altitudes.	Longitudes.	Mean Longitude by Bodies East and West of Meridian.	Remarks.
		H. M. S.	° ′ ″	° ′ ″		
P.M. 6th Oct. 1887.	✳ Fomalhaut	4 34 36·8	47 37 55	35 18 54 E.		A stay of only a few hours was made here.
Morambala Mountn.	East of Mer.	4 41 6·3	49 1 45	35 19 4 E.		
South extremity.		4 46 48·0	50 15 5	35 19 25 E.		Lat. by ✳s N. and S. of Meridian, 17° 35′ 39″ S.
					35 19′ 58″	
Morambala.	✳ Antares,	5 20 39	30 23 53	35 20 48 E.		Very high wind. One set of five observations
P.M. 6th October.	West of Mer.					could only be obtained of ✳ Antares West.
P.M. 14th Oct. 1887.		1 51 26·2	25 30 0	34 51 40 E.	34 51 13 E.	Sky cloudy, with high wind. No obs. could be
Katunga. On Shiré	West of	1 54 27·7	24 46 51	34 51 12 E.	Approximate	obtained of body East of Meridian, as only a
river a little below	Meridian.	1 57 22·0	24 4 45	34 50 57 E.	Long. by obs.	short stay was made at Katunga.
Murchison rapids.					of Body W.	
					of Mer. only.	Lat. Katunga by ✳s N. & S. of Mer. 16° 4′ 45″ S.
A.M. 18th Oct. 1887.	East of	4 58 17·2	23 52 5	35 0 48 E.		
Mandala, on Shiré	Meridian.	5 1 38·0	24 40 25	35 0 57 E.		
Highlands.					Long. upon 18th Oct.	
P.M. 18th Oct.	✳ Antares,	4 38 0·7	29 1 28	35 2 42 E.	35 1 50 E.	The close approximation of results obtained
Mandala.	West of Mer.	4 45 26·3	27 21 30	35 2 40 E.		upon the 18th and 23d Oct. respectively may
		4 49 16·3	26 30 1	35 2 44 E.		be pointed out in proof of the accuracy of the
						Rates fixed upon by observations, and of the
A.M. 23d Oct.	East of	5 6 53	26 30 50	35 0 57 E.		steady going of the chronometer.
Mandala.	Meridian.	5 10 8·7	27 17 33	35 0 49 E.		° ′ ″
					35 1 42 E.	Lat. Mandala by ✳s N. & S. of Zenith, 15 47 25 S.
P.M. 23d Oct.	✳ Antares,	4 32 13·2	25 55 57	35 2 23 E.	Long. upon	Long. Mandala by mean of obs. on 18th and 23d October 1887, 35 1 46 E.
Mandala.	West of Mer.	4 45 7·3	23 2 51	35 2 42 E.	23d Oct.	

TABLE OF LONGITUDES (*continued*).

Date and Place of Observation.	Heavenly Body observed.	Times by Chronometer.	Apparent Altitudes.	Longitudes.	Mean Longitude by Bodies East and West of Meridian.	Remarks.
		H. M. S.	° ′ ″	° ′ ″	° ′ ″	
P.M. 20th Oct. 1887. Blantyre, Shiré Highlands.	✻ Antares, West of Meridian.	4 31 19·8	27 29 17	35 3 23 E.		*Note.*—*B.* chronometer was used in observations taken at Blantyre. Correction of *B.* upon *A.* chronometer, +5′ 38·0″.
		4 35 20	26 35 31	35 3 27 E.		
					35 2 26 E.	In June-July 1884 the Long. of Blantyre was fixed by me by means of lunar distances, and the mean of 82 sets selected by the Royal Geographical Society of London was 35° 3′ 52″ E. (see *Proceedings of Royal Geographical Society*, August 1885, p. 538), a difference of 1′ 26″ only from the present result by independent observations.
P.M. 20th Oct. Blantyre.	✻ β Ceti, East of Mer.	4 45 56·7	39 1 24	35 1 25 E.		
		4 50 6·2	40 0 26	35 1 27 E.		
P.M. 31st Oct. 1887. Livingstonia, Lake Nyassa.	☉ West of Meridian.	2 1 8·3	23 38 38	34 51 42 E.		
		2 4 2·8	22 56 45	34 51 54 E.		
					34 51 13 E.	
A.M. 1st Nov. Livingstonia.	☉ East of Meridian.	5 7 47·1	27 3 56	34 50 40 E.		Lat. Blantyre by ✻s N. & S. of Mer. 15° 47′ 10″ S.
		5 13 59·7	28 33 3	34 50 36 E.		,, Livingstonia ,, 14 2 15 S.
P.M. 2d Nov. 1887. Bandawe, West coast of Lake Nyassa.	☉ West of Meridian.	1 51 32·4	26 16 37	34 12 31 E.		,, Bandawe ,, 11 56 0 S.
		1 54 8·5	25 39 14	34 12 28 E.		,, Karonga ,, 9 57 0 S.
					34 12 18 E.	
A.M. 3d Nov. Bandawe.	☉ East of Meridian.	4 58 27·0	23 55 52	34 12 12 E.		
		5 1 29·3	24 39 26	34 12 2 E.		
A.M. 6th Nov. 1887. Karonga, N.W. coast of Lake Nyassa.	Planet Venus, East of Meridian.	2 41 54·3	28 33 49	33 58 32 E.	33 58 25 Approx. obs. being on one side of Meridian only.	An attack upon Karonga station by Arabs, when I was there, prevented the completion of longitude observations.
		2 46 36·3	29 42 51	33 58 16 E.		
		2 51 4·5	30 48 44	33 58 27 E.		

THE GEOGRAPHY OF THE CAUCASUS.

By Victor Dingelstedt,

Hon. Corr. Mem. R.S.G.S.

Among the countries of the world which have always exercised a certain attraction for those who love adventure, the Caucasus, with its magnificent scenery, its snowy mountains and ever-green valleys, its fair and brave population, and its mysterious history, undoubtedly occupies a prominent place. The ancient myths of Egypt and Greece, the oldest narratives of the world's history in the Bible, the most venerable legends of a great many ancient and modern nations, bear testimony to the great interest with which the Caucasus has always been regarded. This interest never completely disappeared for any length of time, though the fluctuating destinies through which the Caucasian Isthmus passed gave it at times a different aspect—religious, military, political, and social. However, the means for satisfying this interest have often been wanting, or at least very difficult to obtain. The literature of the Caucasus in all languages would form a large library, and there is no apparent reason why those who make the study of the Caucasus their speciality should not obtain the name of Caucasologists, or that this title should not become as honourable as those of Egyptologists or Assyrialogists. In the case of the Caucasus, it is true, no preliminary study of hieroglyphics or of cuneiform characters is required, but in regard to its highly interesting ethnology, at least a special and not less difficult training in unwritten vernacular languages is essential. There is in Russian a word —*Kavkasovédénie*—which signifies the study of things relating to the Caucasus, and may be translated into Caucasology; but this term is as yet quite unknown in Western Europe. The explanation is perhaps due to the fact that so little is really known about the Caucasus, and that the scientists who are chiefly concerned with its study are so inconsiderable in number. In reality, the Caucasus, although no longer a *terra incognita*, is one of the least-known countries in the world, as far at least as the great mass of the educated public is concerned; and this ignorance is scarcely affected by the fact that a considerable library might now be formed of books on the subject. The publications regarding the Caucasus are too widely dispersed, and are written in too many different languages; but had a library been formed and made accessible, the time required to discover what was worth reading and what to cast away would be too great to be sacrificed for the purpose by one in any way capable of forming his judgment by direct observation. Notwithstanding the interest which the Caucasus has excited in the ancient world, its splendid geographical position between two seas, forming a connecting link between two continents, and in spite of its vicinity to the present seats of modern civilisation, the Caucasus has but very recently become the object of continuous scientific attention. Even at the present day, after the tumult of war has here completely ceased, there are many obstacles and considerable difficulties in the way of studying it

more or less thoroughly. In the first place, the science of geography does not rank highly among the studies of those of the inhabitants of the Caucasus who are engaged in the pursuit of general knowledge. The few scientists there are in the country are engaged in the service of the Government, who, of course, promote science, but naturally have to deal primarily with administration, judicial and military, and with problems connected with science only indirectly. There is, secondly, a conspicuous want of appropriate means of training for an intelligent observer. There is no university in the Caucasus; the natural sciences are not adequately dealt with in Russian middle schools, the education bearing mainly upon the study of dead languages; and without being more or less familiar with these sciences, it is, of course, impossible to study properly those laws and associations of phenomena in the life of the earth to understand which is the object of geography. Nor must it be forgotten that in the Caucasus—a rugged, thinly-populated, and yet semi-barbarous country, with few roads, a very rough mountain climate, thousands of precipices, and dangers of many kinds—the work of an independent geographical observer presents difficulties quite unknown in European countries far more advanced in civilisation.

The work is done, however, though slowly and haltingly. The object of the present paper is to give some idea of what is actually being done, or has been done, in the Caucasus, for the object of advancing its geographical knowledge. The retrospect does not in the least pretend to be complete. I shall first mention those public bodies and institutions which share in the progress of Caucasian geography directly or indirectly, and afterwards take a rapid review of the principal attainments in all the most important branches of geography.

The Topographical Department of the general staff of the Caucasian army has been occupied, since its creation in 1847, in geodetic surveys, and in mapping the country upon the sure basis obtained by triangulation. It is now aided in this work by the Surveying Department attached to the Civil Courts of Justice, the primary object of which is the delineation of the boundaries of landed property. The geographical work carried on by the general staff of the Caucasian army is of many kinds. It consists, in the first place, in determining the latitudes and longitudes of about one hundred points annually, by means of telegraphic signals and chronometers, and is further concerned with the network of trigonometrical surveys begun in 1847 by the measurement of a base-line on the right bank of the Kura, 5·67 miles in length. On the basis of the results obtained by triangulation, a topographical survey is being executed in the Caucasus, as well as in the Transcaspian country, on a scale varying from 2 to $\frac{1}{2}$ verst to an inch (from $\frac{1}{1000000}$ to $\frac{48}{1000000}$), and at the average annual rate of about 2300 square miles for the Caucasus (mostly on the scale of one verst to an inch), and 5600 square miles for the Transcaspian country (mostly on half the scale: $\frac{1}{1000000}$). There is, besides this, a coast or hydrographical survey carried on in the Black Sea. The strip of coast surveyed is from 2·6 to 7·2 miles in extent; the scale is 1400 feet to an inch, and the annual rate of progress is about 40 square miles. The

Topographical Department of the general staff of the Caucasian army is busily occupied in the preparation of different maps and route-manuals, and some of its members have rendered signal service in the more exact determination of the geoid by pendulum observations in the Caucasus. The Surveying Department attached to the Civil Courts of Justice is charged with a kind of work analogous to that of the British Ordnance Survey, and, as already stated, it has to provide the charts for the land proprietors upon which the limits of their property are indicated. The work is carried on by several land-surveying parties, according to a plan approved each year by the Governor-General, with the concurrence of interested proprietors, and on a scale varying, for the towns, from $\frac{3}{10000}$ to $\frac{12}{100000}$, and for the country, from $\frac{12}{100000}$ to $\frac{24}{100000}$. From 1862, when this survey was begun, to 1886, 37,211 square miles were mapped, and the rate of advance since then has been about 1609 square miles yearly. The operation is carried on by about 200 surveyors each year. It is a work of importance, but there is little chance that it can be completed before the middle of the next century.

Besides these two great surveying departments, military and civil, providing for the essential study of geography, there are also the following institutions, which indirectly contribute to geographical research :—

The Caucasian Department of Roads investigates the avalanches, and thus throws some light upon the movements of glaciers. The Caucasian Mining Department makes geological researches, and brings to light the mineral riches buried under the soil.[1] The Physical Observatory of Tiflis deals with the action of terrestrial magnetism, measures the temperature of the earth, and, conjointly with some meteorological stations, conducts the usual meteorological observations.

The Caucasian Museum possesses a rich collection of botanical and zoological specimens, and of national types and costumes; its Director contributes in a measure to the knowledge of the birds of the Caucasus. The Board of Caucasian Highlanders, taken from the general staff of the army, collects ethnographical materials and publishes them in a printed organ of its own. The educational, or as it is called in Russian the Administration of Teaching Department, besides elaborating and carrying out its programme for the teaching of geography in schools—about the character of which we had occasion to make some remarks in vol. iii. page 196 *et seq.* of this Magazine—is publishing the highly valuable researches of Baron Uslar on Caucasian idioms, and collecting information regarding the domestic handicrafts and the manners of Caucasian indigenes. The Statistical Board of the Caucasus, with the aid of some provincial statistical committees, is occupied with the collection of every sort of statistical data, and especially those concerning the number and the distribution of the population. The Department of Domains investigates the conditions of life of the very numerous peasantry who are established on the lands belonging to the State, and it collects information respecting the distribution and methods of cultivation of every kind of agricultural product. The Archæographical Commission reproduces in a

[1] The Naval Department conducts the Bathymetrical Survey.

magnificent publication the official acts bearing on the history and the ethnology of the Caucasus. There have already appeared ten large folio volumes containing an enormous amount of material, useful not only for the historian but also for the geographer. The Caucasian Agricultural Society, which is maintained by a grant from Government, and has been under its immediate protection for thirty-three years, contributes materially to the knowledge of the Caucasian flora, and studies the conditions which are favourable to the extension of useful economic plants. The Caucasian Medical Society studies topography from the sanitary point of view.

Thus, without prolonging this list, it is evident that there are a good number of official or semi-official institutions in the Caucasus, which do contribute in some way or other to the increase of materials, capable, if rightly interpreted, of enlarging our geographical knowledge of the country. But, besides all those institutions whose share in geographical work is only indirect, occasional, and sometimes problematical, there is in the Caucasus a public body—the Caucasian section of the Imperial Russian Geographical Society—under the patronage of the Government, from whom it receives a grant for the especial purpose of promoting, organising, and recording geographical researches in the Caucasus, as also in the adjoining Asiatic countries. This society has now entered on the thirty-eighth year of its existence, and I may be here allowed to refer to its past history and its present position. The Caucasian Geographical Society was inaugurated on the 22d March 1851, under the auspices and presidency of General Prince Michael Voronzoff, a well-known statesman, whose father, Prince Semsen Voronzoff, had long lived in London (1798 to 1830), at first as Russian Ambassador and afterwards as a private individual, and where Prince Michael Voronzoff himself received his education. The original members of the society at its first meeting numbered sixteen, mostly officers of the general staff of the army. It obtained an annual grant from the Government to the amount of 2000 roubles; the annual contribution from the members was fixed at 10 roubles. Notwithstanding the scarcity of means the society evinced at the start considerable activity; its meetings were frequent and animated, its membership went on increasing, and its publications grew in interest. But those fortunate days were not long. At the end of the same decade which saw its birth the society had to pass through very critical moments; but it did not succumb, and shortly after the crisis came a favourable reaction. The enthusiasm of the first days was never wholly recovered, but the existence of the society became assured. Owing to the general conditions this existence could of necessity only be a somewhat modest and uneventful one. There have been at intervals, however, some occasions of useful activity, and even when the society seemed to be slumbering there have always been some vigilant sentinels who took up the cause of Caucasian geography. The most distinguished of these have been the general officers—Khodzko, Uslar, Stebnitsky; the geologists, Abich, Von Koshkul; the secretaries of the society, Kovalevsky, Zagursky. The Caucasian Geographical Society is now under the honourable presidency of the Governor-General of the Caucasus, Prince Dondukoff-Korsakoff. Its vice-president, who usually presides over its meetings, is General Trotsky,

who succeeded to this post after General Stebnitsky, who occupied it from 1881 to 1886, after the death of General Khodzko. The present secretary of the society for over ten years has been M. Zagursky, of whose services to Caucasian philology we have had occasion to speak in this Magazine. The society has about one hundred nominal members. Its income does not exceed the modest sum of 3500 roubles (£350) a year, which does not as yet admit of the luxury of a local habitation of its own. Its secretary officiates also as librarian and acting editor, for the almost nominal salary of 600 roubles (£60) a year. The publications of the society are of two kinds: Memoirs or *Zapiski* and Bulletins or *Izvestia*. The Memoirs, issued from the commencement by the society, contain extensive papers on subjects in any way connected with the geography of the Caucasus, as also bibliographical and geographical notes; they appear irregularly in bulky octavo volumes of from 550 to 600 pages, and are at their thirteenth volume now. The Bulletins first appeared in 1872; they consist of two parts—in the first part there are reports of proceedings, *comptes-rendus*, *résumés* of communications made at the meetings of the society, and geographical notes; in the second part, or the appendix, there are materials, partly original and partly translations, for geographical descriptions of Persia, Asiatic Turkey, and the Transcaspian region. We have now nine volumes of those *Izvestia* of about the same dimensions as the *Zapiski*. These journals are carefully printed, and are not seldom enriched with maps and illustrations, but they are insufficiently known in Great Britain, *Nature* being, I think, the only periodical which occasionally introduces them to English readers. Our geographical knowledge of the Caucasus has been largely increased by these periodicals, for they contain considerable geographical information of high value, though necessarily of a detached and fragmentary character.

Interest in the geography of the Caucasus is, however, not monopolised by government offices and local scientific societies. It must not be forgotten that the Caucasian Geographical Society is only a section of the Russian Imperial Geographical Society, which has command of much larger means for geographical explorations, and which has never ceased to interest itself in the geography of the Caucasus. Many explorers have been sent from St. Petersburg to the Caucasus, and many valuable contributions to the geography of this country have been made in the publications so well known in the geographical world under the title, *Izvestia Rousskago Geographicheskago Obshestva*, or the papers of Tcherniavsky, Khodzko, Sévertzof, Danilevsky, Von Burmeister, Mouromtzof, Stebnitsky, and many others. Many Russian scientists, who have explored the Caucasus, have preferred to insert their observations in the Memoirs of the Academy of St. Petersburg, or in some of the foreign, especially German, publications, such as *Petermann's Mittheilungen*, or even the *Russische Revue*. Local correspondents of Caucasian newspapers in Russian and vernacular languages (and the number of them is not unimportant) have made observations of many geographical facts, and there is, in these periodicals, much scattered geographical material of value. It is, of course, difficult to search these for some grain of valuable information, but the difficulty is already considerably diminished by such works as

those undertaken by M. Seidlitz, who has extracted much geographical data contained in *Kubansky Védomosti* from 1863 to 1875; by M. Voronoff, who did the same during many years in regard to material contained in the gazette *Caucasus*; by M. Kobiakoff, from *Stavropolsky Védomosti*, from 1850-59 and 1877-78. Geographical information is also to be found in the *Kavkasky Kalendar*, a semi-official publication, appearing every year (since 1848) in Tiflis.

The Caucasus has always inspired the scientific world and daring adventurers with great interest. From the time of Strabo, and even long before him, to our own days, a considerable number of distinguished explorers and men of science have come into the Caucasus, and have made public what they have seen, or perhaps imagined they have seen.[1] The whole amounts to a very considerable bulk, without the knowledge of which it is impossible to be familiar with the geography of the Caucasus, but its importance must not be overrated.

It is hardly possible to determine our present knowledge of the Caucasus so as to distinguish exactly between what has been done by foreign visitors and what by the men who have made the Caucasus their home; but, without in the least disparaging the great services rendered to the geography of the Caucasus by distinguished foreigners, who have made a more or less short stay in the country, it is highly probable, and, perhaps, only just to acknowledge, that the local workers, knowing Russian and vernacular languages, and enjoying greater advantages for a prolonged investigation, have contributed the major portion to the common stock of positive geographical knowledge. It is, of course, necessary to make, in both cases, a clear distinction between individual workers. There are many travellers whose testimony is of very little value, as there are also a considerable number of residents in the Caucasus whose geographical contributions do not advance science much; but the errors of the latter are more liable to detection. The false or inaccurate observations of foreigners, thanks to the general ignorance of the Russian language, travel a long way, and are not seldom accredited for a very long time; one is sure to find such errors in almost every geographical book about the Caucasus published in European (non-Russian) languages; and these errors are often of an astounding character, showing an almost incredible carelessness, together with the most extraordinary assertions. The fullest description of the Caucasus in any European language has been attempted by M. Elisée Reclus in his well-known *Géographie Universelle* (vol. vi.), but notwithstanding the mastery with which this eminent geographer treats his subject, and though he has relied mostly on Russian sources, his descriptions are not only far from being complete, but are also full of assertions that should be received with great caution, and some are quite erroneous. There is little clew to the sources which M. E. Reclus has adopted; among some that are good, there are many which are superficial, unscientific, and quite out of date. Testimonies of high value

[1] The best-known foreign explorers of the Caucasus have been:—Marco Polo, Chardin, Tavernier, Tournefort, Carl Ritter, Lambert, Pallas, Klaproth, Reineggs, Dubois de Montpéreux, Von Haxthausen, Eichwald, Güldenstedt, Gamba; and, more recently, Petzhold, Dulaurier, Freshfield, Favre, Cunningham, Mounsey, Bernoville, Déchy, and others.

are put by him on the same level with testimonies of no value whatever, without it being made possible for the general reader, ignorant of the originals, to discriminate between them. The author takes in faith many geographical fables long exploded, he makes a number of quite unwarranted assertions, his transcription of geographical names is often wrong, and his translations of many local names into French are rather daring. It is only too evident from the pages of the *Géographie Universelle* that the author had not the opportunity of judging of things himself, and that he sometimes found himself obliged to draw up his information from unreliable books coming into his own or his contributors' hands. With all these defects the geographical description of the Caucasus by E. Reclus is none the less the most reliable and complete guide in any European language for the study of this country.

I have dwelt on the work of the eminent French geographer because of the reputation it enjoys, but it would be easy to multiply the proofs of how deficient European literature is in geographical works of real scientific value regarding the Caucasus. Whilst affirming a preference for the Russian and vernacular literature, I do not mean to say that it would be sufficient to give one a full idea of the progress of the geography of the Caucasus without studying the numerous contributions made to this literature by distinguished foreigners. The number of books written on the Caucasus is rather misleading in both local and foreign literature. The laborious work of M. Miansarof, *Bibliotheca Caucasica et Trans-Caucasica*, gives the titles of about nine thousand books, pamphlets, and articles relating to the Caucasus, chiefly in the Russian and vernacular languages, but one would be greatly mistaken in judging of the results by the quantity of ink employed.

The Caucasian Geographical Society records in its publications much of what is being done for the geography of the Caucasus by scientific bodies and independent European and Russian travellers. It is exceedingly difficult, however, to sum up the exact state of the geographical knowledge of the Caucasus, no very serious attempt having been made to collect and elaborate into a treatise on the subject the voluminous geographical materials dispersed through Russian, foreign, and vernacular periodicals. As the most successful of partial attempts made in recent times to write a comprehensive book on the Caucasus, I must point to that prepared under the direct patronage of the Governor-General of the Caucasus, Prince Dondukoff-Korsakoff, by a functionary and amateur geographer, M. Weidenbaum. M. Weidenbaum's book bears the title of *A Guide to the Caucasus*, and has a map and twelve engravings: it consists of a description of the roads and principal places of interest to the traveller, a summary of the geography and ethnography of the Caucasus, and an historical sketch of the extension of the Russian Dominion upon the Caucasian Isthmus and of the Caucasian War. The author presents his work as the first attempt at a systematic review of the whole of the Caucasus ever made in literature. We must consider the attempt as a worthy one, without, however, overrating its importance to geographical literature. It is a fairly reliable guide to those who visit the most frequented parts of the Caucasus with no further scientific interest than

that afforded by a very general conception as to the nature of the country, its inhabitants, and the principal events of its history. From the geographical point of view, the second chapter of the sixth volume of the *Géographie Universelle*, by Reclus, certainly presents far greater interest, though the statistical data and the proper names in the work of the French geographer must be received with some caution.

Without attempting a geographical description of the Caucasus—a task that would be far above our ability and knowledge—we will now briefly review some of the principal branches of information concerning its geography, in order merely to give to the reader of this Magazine a clearer idea of the geographical work that has been accomplished. Beginning with the physical aspect of geography—geodetic and topographical work, orography, geology, study of glaciers, seismology, hydrography, climatology—we will pass to its biological aspect—flora, fauna, ethnology, ethnography, statistics—and conclude with a very short sketch of the historical aspect of Caucasian geography.

Geodetic and Topographical Surveys.—As already hinted, in this field of research, properly constituting the basis of scientific geography, considerable ability and zeal have been shown, under the intelligent direction of the Topographical Department of the Caucasian Army and the Surveying Department of the Caucasian Courts of Justice. The trigonometrical survey of Transcaucasia, begun under Khodzko in 1847, was successfully finished in seven years; the geodetic survey of Daghestan and Ciscaucasia, begun in 1860, was finished in 1865.[1] The whole has been carried out at 2000 stations, in spite of war, fevers, and many adverse circumstances. Of the difficulties which attended this work the reader may judge from what was said about it by Mr. E. Delmar Morgan in the November (1888) issue of this Magazine. Simultaneously with the triangulation some astronomical work was carried on: latitudes and longitudes were determined by means of chronometer and telegraphic signals. The comparison of the results obtained, the determination of a given point by geodetic and astronomical media, have occupied General Stebnitsky, and formed the subject of his work: "Regarding the deviation of the pendulum owing to the attraction of the Caucasian mountains."[2] The same subject—the increase of gravity caused by the Caucasian chain—has also occupied the attention of M. Kulberg, who made various experiments with the view of determining the vibrations of the pendulum on the Caucasus and the true figure or density of the earth's surface. In 1884, Caucasian longitudes were connected with those determined in Western Europe. As soon as a base-line (chosen in a steppe on the right bank of the Kura, between Dallar and Shamkhor, and measuring about 5·67 miles

[1] The first attempt at a survey in the Caucasus was undertaken by the Russians in 1770. But the expedition of MM. Lovitz and Snochodzeff, formed with this object, had a tragical issue. M. Lovitz perished at the hands of Pugatcheff, and his colleague was glad to escape with his life. The second expedition, organised in St. Petersburg in 1785 for the same purpose, with M. Arnoldi as the leader, ended as disastrously. It was only in 1825 that the astronomer Parrot succeeded in determining the geographical position of Tiflis, and of both summits of Mount Ararat.

[2] *Mémoires of Imp. Ac. of Sciences*, vol. xvii.

—4292·61085 saién) was obtained, and a network of triangles (the mean length of sides of our triangles is 33 miles) had been formed, the measurement of details in the field of triangulation was immediately proceeded with. This topographical work is still actively carried on. Topographical delineation on the northern slope of the main chain (one-verst survey), on the scale of $\frac{244}{100000000}$, covers an area of 2373 square miles; that on the southern slope is, we believe, already accomplished. We have now a reliable map of the whole of the Caucasus on the scale of $\frac{48}{100000000}$, whilst about one-half of it is mapped on the scale of $\frac{244}{100000000}$. The ten-verst map was lithographed in Gotha in 1862; the five-verst map was ready in 1870. A relief map of the Caucasus was exhibited in the International Exhibition at Paris in 1867. The area of the Caucasus, including the provinces annexed from Turkey after the Eastern war, was determined by General Stebnitsky in 1861, by means of Amsler's planimeter, at 1,792,046 square miles, of which 857,393 square miles belong to Ciscaucasia. The hypsometrical survey at present covers about 5200 square miles, the altitudes are determined with great accuracy, and the work is still actively proceeding. I cannot speak with authority about the exactitude of our maps, but, though liable to many corrections in their details, they represent, I think, a sufficiently true picture of the principal features of the country, and, in general, the whole work comprises our best achievements in the progress of scientific geography.[1]

Orography.—About six-tenths of the area of the Caucasus is covered with mountains. The main chain of the Caucasus alone covers an area of 56,056 square miles, or nearly four times the area of Switzerland; but there are, besides, the Great Caucasus, the Little Caucasus, and parts of some important mountain ranges of Asia Minor—that of Lazistan, bordering the southern coast of the Black Sea, that of Agridag, on the Russo-Turkish frontier, and that of Talysh, forming the north-western extremity of the Elbruz Mountains on the southern shore of the Caspian Sea. The vastness of the subject is thus evident. It has been the object of many and arduous labours, the results of which have been recognised as sufficiently considerable to confer upon the explorers, such as Abich, Khodzko, Stebnitsky, Stchurowsky, Salatsky, and Von Koshkul, a high scientific reputation. But there is as yet no systematic treatise worthy of the subject, and there are very few exhaustive monographs referring to separate parts of the whole. The best living authority on the orography of the Caucasus is General Stebnitsky, now at the head of the Topographical Department of the general staff of the Russian army. He is

[1] In European geographical literature there have appeared the following more important communications concerning the geodetic and topographical surveys in the Caucasus:—By General Khodzko, "Die Neuesten Höhenmessungen im Caucasus" (*Petermann's Mitteil.*, 1859, p. 303); "Die Russischen Aufnahmen im Kaukasus" (*Ibid.* 1862, p. 361). By General Stebnitsky, "Uebersicht der Kaukasischen Statthalterschaft" (*Ibid.* 1865, p. 121); "Geographische Notizen über dem Oestlichen Theil des Trans-Kubanischen Landstriches" (*Ibid.* 1865, p. 377); "Un Aperçu de l'Histoire Cartographique de Caucase, comme introduction à la carte en 22 feuilles dite 10 versts au pouce" (*Ibid.* 1864, p. 205).

known to have been preparing for many years past the materials for an orographical treatise, but until his expected work is forthcoming, it would be very difficult to get a clear idea of what is known and what is not known, in this branch of the geography of the Caucasus. The best sketch on the orography of the Caucasus, in the Russian language, is at present that of M. Salatsky, written more than twenty years ago, and reproduced in vol. vii. of *Zapiski Kavkaskago otdiela Roussk. Geogr. Obshestva.* It is a valuable paper, and gives the explorations of MM. Abich and Stchurowsky, the directions of the principal watersheds, and the formations of the principal and secondary ranges north and south of the main chain, to the then existing limits of the Russo-Turkish and Russo-Persian frontier. Yet it is only a sketch. The facts and deductions regarding the orography of the Caucasus contained in the important work of M. Abich, "Prodromus einer Geologie der Kaukasischen Länder" (*Mémoires de l'Académie Impériale*, 1858), are of a very searching and truly scientific character, yet they are of far more importance to the geologist than to the student of orography. This work by Abich is very little known, and on account of its involved German style it has been but partly translated into Russian by the late M. Von Koshkul.

There are many papers relating to special orographic areas, but, rather than prolong my article, I will only mention a few here, such as "Mountains on the North of the Main Range of the Caucasus," by Von Koshkul; "Mountains and Gorges of the Terek-Kuban Districts," "Ossetia, the Sources of Rion," by Dinnik; "Chechenia and Daghestan," "Konchi-Daglae and Lower Eichly," by Rossikoff; "Russo-Turkish Frontier, according to the Treaty of 1878," by Stebnitsky.

Geology.—Though geology is usually not included in geography proper, it is so nearly related to it that we may be permitted to refer to it in this place, the more so as the Caucasian Geographical Society has always viewed progress in geology with the same interest as progress in geography proper, and as many of our geologists consider themselves geographers also, and simultaneously with their special study have pursued investigations in geography. The geology of the Caucasus has been especially favoured by the activity of some eminent scientific men, and it is in this field of our subject that most has been accomplished. With a truly German perseverance, during the last forty-two years the Academician, M. Abich, in the service of the Russian Government, has pursued his studies and has published about fifty monographs dealing with different parts of the subject, and evidencing both knowledge and discrimination; but his attempt to crown his busy scientific life by bringing all his researches into a single elaborate treatise has but partly succeeded; death removed him before he was able to conclude the third volume of his useful work, entitled *Geological Researches in Caucasian Countries*, published in German, at Vienna. Thus, in a finished form, we have from him only a description of carboniferous formations in the valley of Ararat, and a detailed account of the orography, geology, and palæontology of the Armenian plateau.

A similar attempt to systematise the numerous geological researches

in the Caucasus, had been undertaken by his worthy disciple and emulator, M. Von Koshkul; but here again inexorable death intervened. In 1886, with the sudden decease of M. Von Koshkul at St. Petersburg, the geology of the Caucasus lost not only an eminent student, who worked for over thirty-four years in his special science, but also an excellent interpreter of the works of M. Abich, whose involved German style prevents his writings from being understood by many. Besides these two geologists, who have explored many regions in the Caucasus, geological researches have been carried on, and are still actively prosecuted, by other servants of the Government, which created some ten years ago a Caucasian Geological Survey, with the object of supervising all work in the exploration of mines and in carrying out investigations into the structure of the land. Already some work has been done, which certainly merits attention, but this is no place to enter into particulars. Caucasian geology also owes something to foreign explorers. The most interesting region of Bechtau was described by the French geologist Léon Dru, and the structure of the Central Caucasus has been studied by Mr. Douglas Freshfield, M. É. Favre, M. Petzhold, Von Thielmann, and others.

The Study of Glaciers.—There is a strange discrepancy in the existing estimates of the extent of the glaciated area in the Caucasus—conclusive proof of how little our glaciers have been studied. Whilst, according to M. Von Thielmann, the Caucasus is covered by ice to the extent of close upon 2000 square kilomètres (770 square miles), the Russian estimates are very low, from 150 to 190 square miles only. The name of M. Abich is the one which we meet with most frequently in the literature concerning our glaciers. He has given some data about the largest glaciers—*Baksan*, on the eastern slope of Elbruz; *Karagam*, on the north-western side of Adaï-Khokh; *Cey*, on its north-eastern side; *Devdorak*, on the north-east of Kasbek; *Tsanner*, on the western side of Tetnuld; *Calde*, on the Adish.[1] Besides by M. Abich, the glaciers of Caucasus were partly explored by the Swiss professor Émile Favre (*Glaciers de la Chaine de Caucase*, *Bibl. Universelle*, 1869); Mr. Freshfield (*Travels in the Central Caucasus*, London, 1869); Déchy (*Petermann's Mitteilungen*, 30 Band, 1884, heft xi.); Grove (*Ibid.* p. 415); and the Russians Dinnik, Stebnitsky, Ivanoff, and Chatissoff (*Izvestia Imp. Russkago Geogr. Obshestva*, vol. ix.; *Izvestia Kavkaskago otd'ela*, vol. v.).

With the exception of Devdorak, the movements of which have been accurately observed for some years, there are no glaciers in the Caucasus about whose movements and meteorological conditions anything positive can be ascertained. Even their actual dimensions are unknown. The largest glaciers are supposed to be on the northern slope of the main chain between Elbruz and Kasbek; they descend here from 4200 to 4900 feet below the permanent snow line, and their formation into vast fields is favoured by the orographical structure of this part of the chain, which throws out gigantic *massifs*. The largest glacier is considered to

[1] *Zapiski Kavkas. otd'ela Russk. Geogr. Obshestva*, vol. viii.

be that of Karagam, or Kalthi-don, on the Adai-Khokh; it is 1500 feet in width, and descends as low as 5700 feet above the level of the sea. The glaciers of Ararat were partly studied by Abich, Khodzko, Moritz Wagner, and others; they descend lower than the glaciers of the Caucasus, and the largest, that of S. Jacques, is said to be 1875 feet above the level of the sea (Abich, *Beiträge zur Kenntniss des russischen Reiches*).

Seismology.—If the study of Caucasian glaciers is not far advanced, still less is to be said of the study of the movements and the upheavals of the earth's crust, which have been so formidable on the Caucasian isthmus in former times, and which are not quite dormant even now. It is only in Tiflis, in the Physical Observatory, that these movements are observed. There are many regions in the Caucasus where volcanic action still manifests itself. Not only are there boiling mud-springs (*salses*) on both extremities of the mountain range, but there are also numerous *salses*, naphtha, and different thermal springs on both sides of the range. Earthquakes take place very far from the two main centres of subterranean energy—Shemakha and Ararat. The seismic movements at the first centre run north-west and south-east, and in the regions of Ararat they have a west and east direction.

The ancient, now extinct, volcanoes are very numerous at the points of intersection of different upheavals in the main range (Elbruz, 18,572 feet; Kasbek, 16,546 feet), but especially in the Little Caucasus (Ararat, 16,916 feet; Alaguë, 13,436 feet; Agmangan, 11,902 feet). Many extinct volcanoes in the Little Caucasus are also found in a line (Samsar, 10,777 feet; Godoreby, 10,466 feet; Great Abull, 10,826 feet; Little Abull, 9192 feet).

The latest important manifestations of volcanic action have been in 1799 and 1814, when islets were formed in the environs of Temruck; in 1840, when the eruption of Ararat took place and destroyed the village of Arkhuri; in 1859 and 1872, when the town of Shemakha was again destroyed.

The shores of the Caspian at Petrovsk, and those of the Black Sea in Abkhasia, appear to be rising, whilst in some other places they seem to be subsiding.

There are over one hundred *salses* (mud volcanoes) in the peninsula of Taman alone; they are divided into five groups, and not unfrequently they change places. There are also numerous *salses* on the Apsheron peninsula. The thermal springs are distributed along the three principal lines of upheaval of the Caucasus,—southern (Sleptsoff, Michailowsk, Tiflis, Borjom, Abbas-Touman), from north-west to south-east (many sulphur springs on the north-eastern foot of Daghestan, Isti-su, Eski-Endery; alum springs of Achta); and from south-west to north-east, which is the direction of the principal thermal springs of the Caucasus (Piatigorsk, Kislovodsk, Jelesnovodsk, and Essentuki).

The seismic movements have been partly studied by Abich, Von Baer, Bayern, Prendel, Tcherniavsky, and others, but on the whole the recorded observations are few, and the problems remaining unsolved are very many.

HYDROGRAPHY.—The rivers that drain the Caucasus are very numerous, some of them, *e.g.* Kuban, Terek, Kura, Aras, Rion, are very considerable, many of them are of the most vital importance to the country, and yet neither the hydrography nor the hydrology of the Caucasus have attracted the attention they deserve. The hydrography of rivers has occupied many engineers in the service of the Government; they have studied some Caucasian rivers from the standpoint of the service they may render to irrigation and navigation; but the geographical features of the rivers, their character and peculiarities, have never been carefully considered on a large scale. Even the preliminary survey for the object of utilising our rivers has never been carried out in a sufficiently thorough and systematic manner, except in the case of an English engineer, Mr. Gabb, who was engaged by Field-Marshal Bariatinsky, in 1860, to draw up a scheme for the irrigation of eastern Transcaucasia. Mr. Gabb worked for about three years; he carefully studied the system of the Kura and its affluents, gathered a quantity of observations, and constructed a very elaborate plan for distributing in the best way possible the waters of the Kura and Aras. Unluckily those investigations, conducted with an energy and skill deserving the highest commendation, led to almost no practical results, in consequence of the utter inability of the country to furnish the capital necessary to the realisation of the vast project conceived by Mr. Gabb, and perhaps also from want of perseverance on the part of the authorities. What had been accomplished by Mr. Gabb in order to determine the discharge of rivers draining eastern Transcaucasia, remains however as a legacy to science, though the gain is necessarily diminished by the fact that rivers are of a changeable nature, and that the data obtained by Mr. Gabb are a quarter of a century old.

Some fragmentary investigations concerning the Caucasian rivers have of course been carried out here and there in the last twenty-five years: the Kuban has been studied by the engineers Linnikoff, Jogel, Von Burmeister, Krassovsky, Jarintzoff, Jilinsky, and Levitsky: the Terek has been the object of investigations by Bulmering, Ivashintsoff, Litvinoff, Gaydatell, Romanoff, Petersen, Dall, Okulitch; the drainage area of northern Ciscaucasia, between Azov and the Caspian, has been explored by Daniloff, well known for his vast project of a water communication across the steppes between the two seas; the Kura has been studied by the engineers Petroff, Weissenhof, Sokoloff, Statkovsky, Latzinnikoff; the Rion by Jarintzoff; and other cases might be cited. But, notwithstanding the real importance of many of these labours, executed at the command of the Government, and the considerable zeal and activity therein displayed, I must maintain my previous assertion of the total inadequacy of our hydrographical researches. A proof of this may be seen in the meagreness of the data contained in the recent Russian publication of the engineer Gersevanoff, "A Sketch of the Hydrography of the Caucasus,"[1] though the author has compiled almost all the information to be had about Caucasian rivers, and though, from being many years at

[1] *Otcherk Hidrographii Kavkaskago Kraja*, St. Petersburg, 1886.

the head of the Building Department of the Caucasus, and President of the Caucasian Technical Society, he was, of all men, the most competent to treat this matter. From what can be gathered from this and less important works on the hydrography of the Caucasus, it is not possible even to trace a list of Caucasian rivers, such as I was recently enabled to do for the rivers in the remotest part of Central Asia.[1]

Climatology.—This branch of the physical geography of the Caucasus is in its infancy. Meteorological observations are carried out at some twenty-eight stations, dispersed throughout a mountainous country of above 182,000 square miles in area, and subject to the greatest variety of climatic influences. Besides, these few stations are not regularly attended, and, in some cases, are only in charge of students under the casual supervision of their teacher. The observations recorded, with the instruments in ordinary use, of the temperature of the air, the quantity of the rain, and the direction and strength of the wind, are sent daily by telegraph to Tiflis, and are dealt with at the Physical Observatory, where meteorological and magnetic observations are made hourly, and absolute measurements of terrestrial magnetism obtained. From 1883 the Observatory began to take observations of the temperature of the earth at different depths; from June 1882 magnetic observations, according to the programme of the International Polar Commission, have been carried out. All these records are sent to St. Petersburg, where they are collated by the Central Physical Observatory for the computation of general results obtained from the whole of Russia.[2]

The climatology of the Caucasus has occupied Salatsky (*Zapiski Kavk. otdiela*, vol. v.), Stebnitsky (*Izvestia Russk. Geogr. Obsh.* ix. N. 5), Statkovsky (*Problèmes de la Climatologie de la Caucasie*, 1868), Abich (*Zapiski Kavk. otdiela*, vol. v.), Voyeikof, and others. There are many records of the climate of the Caucasus in the numerous books and pamphlets written about this country, but on account of the scarcity of positive data, no serious attempt to treat the matter in a thorough manner could have been made as yet, and we possess only very general and rather fragmentary indications of the climate of the country.

With great local variations the climate of the Caucasus may be roughly characterised as continental on the great Armenian plateau, in eastern Transcaucasia and Ciscaucasia, and as maritime in the basin of the Rion, and on the narrow eastern shore of the Black Sea. The greatest variation between the mean highest and the mean lowest temperature of the hottest and the coldest months of the year is presented in the high Armenian plateau, where, as in Erivan, it attains 36° C. (mean monthly, January − 9°·5; August + 26°·2). It is least on the eastern shore of the Black Sea; for instance, at Sukhum it is only about 18° C. (mean monthly, January + 6°·1; August + 24°·4). The highest mean annual temperature (14°·7 C.) was experienced in Lenkoran,

[1] *Scottish Geographical Magazine* for December 1888.

[2] The Central Physical Observatory published last year a bulky volume (506 pp. in 8vo) on the rainfall of the Russian Empire up to 1882.

Sukhum, and Poti, the lowest in Ardagan 2°·7 (6019 feet above sea-level), and Gudaur 3°·3 (7245 feet). There is no meteorological station at a higher altitude than this last. Both records of temperature are open to question in view of the insufficient number of observations.

The distribution of moisture is most unequal: the eastern coast of the Black Sea and the south-eastern corner of Transcaucasia (the district of Lenkoran) are almost as rainy as Portugal, Norway, and the high Alpine valleys (from 1202 to 2112 mm.), whilst the western shore of the Caspian and some parts of the Armenian plateau are as dry as Castellon de la Plana (Spain) or even as Chenab (Punjab)—(about 230 mm.). The reason of this contrast is to be sought in the distribution of the mountains and the prevailing winds. The ramifications of the main chain north of Elbruz (Tashly-syrt) and south of Shkara (Meskhi or Suram) check the moist winds, and the moisture they contain is almost wholly discharged upon the western slopes of the mountains. The moist winds of the Caspian on the other hand are arrested by the mountain range of Talysh, and thus the vast country drained by the Terek and Kura is under the influence of dry winds, which is exemplified in the dreary desert of Ust-Urt.

The atmospheric pressure is highest in winter and lowest in summer. Of 100 windy days in summer there are about 72 days when the wind blows landward.

Fauna and Flora.—For the study of the natural history and the ethnography of the Caucasus there exists at Tiflis a museum with a rich collection of specimens of vegetable and animal life, as also of objects illustrating the customs and habits of the Caucasian aborigines. The director of this museum, M. Radde, an ornithologist, is largely endowed by the Government with the means for constantly increasing his collection, and making further discoveries.

There are many botanists, from Lamberti to our times, who have paid attention to the Caucasian flora. We have many learned naturalists in the service of the Government, who are now continuing their studies, and as regards the number and varieties of vegetable species there are probably not many new discoveries to be made.

For the purpose of promoting the cultivation of useful plants and for the study of botany the Caucasian Agricultural Society was established at Tiflis in 1855, with an annual grant from the Government, and under its auspices. This Society, which now possesses an experimental ground of its own, has materially contributed to the knowledge of the Caucasian flora, its extreme limits, and the conditions under which the different species of plants grow. But, whether sufficient material for a systematic treatise on the vegetable world of the Caucasus is already accumulated or not, a description has been really undertaken principally in reference to phanerogamic plants, of which there are 4000 species, viz., trees and bushes (Medvedeff, *Sbornik Kavkaskago Obsh. Selskago Khozaistva*, vols. v. and vi. 1883), fruit-trees (Geefsky), vascular plants (Smirnoff), and some others.

As regards botanical geography, very little is known. Perhaps a

single general fact in this domain, due to the unequal distribution of heat and moisture, is positively ascertained, viz., that in the western part of the main range, the limits of vegetation generally lie on its northern slope some 2000 feet above those limits on the southern slope, and that approaching towards the east, this difference between the limits of altitude to which vegetation attains on both slopes goes on decreasing, with a simultaneous increase of the altitude itself at which this limit is attained. But it is in the Little Caucasus that vegetation attains its highest limit, namely, 13,120 feet.

Fauna.—The Caucasian fauna has been studied by Güldenstedt, Menetrié, Nordmann, Krynitsky, Kessler, Bogdanoff, Radde, and others. The results of their studies, though important in many respects, are, however, according to authoritative statements, very far from being complete, and thus there is yet open a vast field of study and for further discoveries. It is somewhat remarkable, that the greatest services to the zoological researches in the Caucasus have been rendered, not by those who reside there, but by zoologists who came to the Caucasus on scientific excursions. It is to M. Kessler that we owe the fullest description of the fishes, amphibians, and reptiles found in this region; and to M. Bogdanoff, who died last year in St. Petersburg, the most complete account of birds found in Caucasian woods. The work of the first appeared (in Russian) in 1875-78, and that of the second in 1879. Subsequently another work on Caucasian birds (*Ornis Caucasica*) came from the pen of M. Radde, but it did not greatly add to our knowledge. In the same interesting field of study are now engaged, with profit to science, two young zoologists, Rossikoff and Dinnik. The crustaceans have been especially studied by M. Tcherniavsky, and ichthyology by M. Sokoloff. Fourteen years ago an attempt was made to form a society of amateur naturalists, but the attempt proved a failure. The society became extinct after eight years of uneventful existence. There is no university in the Caucasus, scientific men are few, and there are some scientific societies whose existence is nominal rather than real.

Ethnology and Ethnography.—The subjects comprised under these heads have exercised the curiosity of many *savants* who have visited the Caucasus. The ethnical distribution of the Caucasian population is very varied, comprising at the present time about fifty nationalities.[1] The great diversity of physical conditions, combined with the great difficulty of intercommunication, must have determined, for all the ethnical elements of the Caucasian population, their considerable share of independence. According to Uslar, the most competent Caucasian ethnologist, the mountains have been occupied by inhabitants from the plains, especially from the north; the earliest arrivals were probably the prehistoric aborigines of Europe, then the Aryan races, now reigning in Europe, and simultaneously, Finnish races on their migration from the Altai to the Baltic; later came the Daco-Gethæ (Scythian) races.

[1] See my paper, "Caucasian Idioms," in the *Scottish Geographical Magazine* for June 1888.

Afterwards, from the beginning of the Christian era, many other nations, moving from east to west on the great road of migration between the Ural and the Caspian—such as Huns, Alans, Avars, Magyars, Turks, and Mongols—have also contributed ethnic groups, which, being intercepted on the isthmus between two seas, were not able to proceed westwards with the rest. Thus the northern half of the Caucasian isthmus had, to the continent of Europe, much the same historical relationship as its southern peninsulas, the Balkan, Italian, and Iberian. The southern half of the Caucasian isthmus was first inhabited by the remnants of nations which moved from Turan through Mazanderan, and from Thracia into Asia Minor. In this way two great currents of migration from Asia into Europe, north and south of the Caucasian isthmus, came into touch across the great Caucasian range, which, in its profound gorges and impassable defiles, absorbed those families that were left behind and could not follow the great movement. The great Caucasian wall itself has ever separated, and continues to separate, though not so rigorously as of old, two distinct civilisations, consequent on the two distinct movements. It is very difficult to acknowledge adequately all the efforts which have been made in order to accumulate ethnographical material, and to construct ethnological explanations concerning the multitude of different nations and tribes which inhabit the Caucasus. Besides many amateur ethnographers and true *savants*,—*e.g.* Chev. d'Ohsson,[1] Defrémery,[2] Brosset, Lafinsky,[3] Erckert, Pfaff, Miller, Dulaurier, Rittich, Vénukoff, Zagursky, Ippolitoff, Kharasin, Komaroff, Seidlitz, and especially Uslar, who have concerned themselves with Caucasian ethnical problems—there are now in the Caucasus two or three official institutions which gather ethnographical material, and issue their special publications on the subject. There are :—the Board of Highlanders, which issues a periodical, *Magazine of Information concerning Caucasian Highlanders ;* the Board of Schools, which has its *Magazine of Materials for the Description of Caucasian Sites and Nationalities ;* and there is also a Department of the Ministry of Domain, whose representative, Private Councillor Tikhéef, has undertaken, by means of special commissioners, an exhaustive description of the conditions in which the peasantry live on the estates of the Imperial Domain —constituting almost one-half of the landed property in the Caucasus —and there have appeared some bulky volumes on this subject. All these publications, as also most of the monographs in other periodicals, have, however, only the value of rough materials which await a great scientific mind capable of mastering them, and of constructing a more or less comprehensive synthesis of the whole. I must, however, hasten to acknowledge that the ethnology of the Caucasus has acquired a true scientific basis by the linguistic researches of Baron Uslar. This eminent linguist held the opinion that language and topography throw a clearer light upon the former destiny of a people than do the dead chronicles of events through which they pass. In my former paper, on

[1] *Des Peuples du Caucase*, Paris, 1827.

[2] *Nouv. Journ. Asiatique*, 4 ser., vols. xiii., xiv., xvi., xvii. (1849-51).

[3] *Die Bergvölker des Kaukasus*, Hamburg, 1863, 2 vols.

"Caucasian Idioms," I have given a short history of our linguistic researches, and I do not require to repeat myself here. Whether further efforts in linguistic studies will in any degree realise the high hopes Baron Uslar attached to it, I dare not prophesy; but what I am sufficiently sure of, is that those efforts, in order to succeed, must be prosecuted with far greater energy than is the case at present.

STATISTICS.—The collection of data bearing on the census, ethnographical distribution, inhabited localities, industrial pursuits, and similar matters, is incumbent upon the Central Caucasian Statistical Committee, whose worthy editor, M. Seidlitz, has succeeded in giving to the world nine bulky volumes under the general title—*Sbornik Svedenij o Kavkasé* (Magazine of Information regarding the Caucasus). The Committee has, as correspondents, official statisticians in every Caucasian province, and is in a great degree dependent upon the assistance of the police, whose members do the real work of collecting the necessary data. Statistical information thus gathered with scanty means, by men already overcharged with police duties, amidst an ignorant and distrustful population, cannot surely be a marvel of exactitude, and really they lack this important quality in a marked degree. Yet even when only partially true, statistical data in the hands of an experienced investigator always have some value, but what is to be regretted in this matter is the want of unity of purpose, and the haphazard character of the proceedings. An exception must be made, however, in favour of the considerable work undertaken by the Central Statistical Committee, to collect a register of all inhabited localities, and publish information as to the number of people residing in each locality, and their division according to sex, age, religion, nationality, education, social position, families, etc. This work is founded on the information brought to light by the census undertaken by the Government in 1873, and later in 1886. The chief merit of this important work belongs to M. Seidlitz, who as early as 1870 prepared a complete register of the inhabited localities of the province of Baku, with plenty of interesting particulars, and who has edited quite recently a register of all inhabited localities in the province of Elizavetopol,[1] with a map and numerous statistical data, which must, however, be cautiously received.

Besides the Central Statistical Committee, there are provincial committees, but in both cases the name of committee is rather misleading, for the work rests in every case only on one man, and where some real work is done, as for instance in the case of the Kuban Statistical Committee, it is only when that man (M. Felitzyn) is active and intelligent.

I have already mentioned, as regards this important statistical work, a modest imitation of the statistical survey undertaken in India by Sir W. W. Hunter, which is directed by M. Tikhéef, in regard to the conditions of life of the peasantry on the estates of the Imperial Domain. There have already appeared four bulky volumes of this work under the title, *Materials for the Study of the Economical Conditions of the Peasantry on the Domains in the Caucasus.*

[1] See Article in this month's Magazine by M. Seidlitz.—EDS.

Historical Aspect of Caucasian Geography.—There are four sources from which this study is derived—the Bible, Greek and Roman classics, Oriental classics, and vernacular, mostly Armenian, historical literature.

In the Bible are mentioned many names such as Havilah, Jabal, Tubal, Sinhar, Cush, Meshech, Gog, Magog, and others, which are interpreted as indicating the peoples which inhabited or traversed the Caucasus. Of interpretations of the Bible there are a great many, but the best explanations in reference to our subject are to be found in Uslar's work, *Drevnie'shie Skazania o Kavkasé*.[1]

The Greeks and Romans knew nothing of the interior of the Caucasus previous to the expedition of Pompey the Great, which first opens an era of positive knowledge of this country. The works of Hekateus and Pherecydes, and the trilogy of Æschylus, throw a very feeble light upon the geography of the Caucasus. Herodotus, who had been on the south-eastern shore of the Black Sea, though very truthful, does not shed much light upon our subject, and there is, moreover, some difficulty in harmonising his statements with those from other sources. Strabo, of course, possesses a far greater importance in our eyes, and his information concerning the geography of the Caucasus has been commented upon by Vivien de S. Martin,[2] Uslar, and others. Other Greek and Roman writers on the Caucasus—Xenophon, Tacitus, Diodorus of Sicily, Procopius of Byzantium—are rather visionary, and in every case what they relate of the Caucasus they knew only from hearsay.

Oriental classics of a later period—Zemarch (vi. century), Massoudy (ix.), Istakhry (x.), Edrisi (xii.), Abul-gasi (xiii.), Hamdulla (xiv.)—do not generally command great confidence; their information is often spoilt by exaggeration, and is certainly not always unbiassed, though it was diligently studied by many savants—Chev. d'Ohsson, Defrémery, S. Martin,[3] as well as by Armenian writers.

The vernacular literature on the geography and history of the Caucasus from Moses of Chorene,[4] who is the Herodotus of Armenia, to our time, is voluminous, and certainly contains much solid information, and it is not in vain that many eminent men of science—Brosset, Indidjian, Patkanof—found it worth their while to translate and to comment on its best products.

It has already been observed that the Caucasus Mountains have always constituted a great barrier to the limits between two currents of Aryan civilisation. It is evident that those nomads who were forced to abandon their migratory life, and settle down in the mountain gorges of the Caucasus, were early obliged to change their mode of life completely. A strong connection was thus established very early between man and the soil in the Caucasus, and the rich plains of the Kura and the Araxes soon became important seats of civilisation. The large cities and

[1] *Zapiski of the Cauc. Sec. Imp. Russ. Geog. Soc.*, vol. xii. 1881.

[2] *Études de Géog. anc. et d'Ethnog. Asiat.*, vol. ii., 1852.

[3] *Recherches sur les Pop. primitives et les plus anc. du Caucase*, Paris, 1847; and *Mém. Hist. sur la Géog. anc. du Caucase*, Paris, 1848.

[4] *Hist. Armeniacæ*, London, 1736.

cultivated lands attracted, however, the attention of the northern Barbarians, and very early in history we hear of incursions into Transcaucasia, *e.g.* the Gomers of the Bible, Scythians of Herodotus, Cimmerians of Strabo, etc. Civilised Asiatics spared no efforts to render the mountain barrier that protected them from the north more inaccessible by fortifications. Things are in much the same state as they once were on the two sides of the Himalayas. The south has had everywhere (*e.g.* Balkan, Italian, and Iberian Peninsulas) to defend itself against the invading north, and the struggle is not everywhere terminated at the present day. It would be tedious and out of place here to record what is known of the very long struggles between nations for possession of the rich plains of Transcaucasia. We know that this struggle came to an end, and we may surely consider as quite visionary the view of those few who, with Mr. Oliver Wardrop,[1] continue to entertain any doubt as to its outcome. What may still be of interest, and what we consider as proper for the conclusion of this paper, is a very short account of the last stage of the struggle. Georgia, ruined by Aga Mahomet Khan, and harassed by every kind of disorder, was annexed to Russia on the 6th October 1801. At this date Transcaucasia was divided into a great number of petty rival principalities, some independent, some under the influence of Turkey, some depending on Persia, and some acknowledging the supremacy of Russia, but avoiding as far as possible any practical consequences of this acknowledgment. The influence of the Mussulman powers could not, however, be long tolerated by Russia. The war with Turkey from 1807 to 1812, the campaign against Persia from 1808 to 1813, and again from 1826 to 1828, and the Turkish war of 1828-29 have put an end to this influence. The petty principalities and khanates could still less defer a fuller recognition of their real master. The principality of Mingrelia, occupied by Dadians, delivered its political destiny into the hands of Russia in 1803. The khanate of Ganze was annexed to Georgia during the next year. Some months after the storm of Ganze the Tsar of Imeretia acknowledged himself and his possessions as subject to Russia. The principality of Guria ended its political independence six years later, and Abkhasia soon followed, increasing the already very considerable dominions of Russia on the Asiatic side of the Caucasus. The possession of the mountains remained, however, long disputed. The Caucasian war, conducted under incredible difficulties and with almost superhuman courage, lasted from the beginning of the century (1816) to 6th September 1859 in Daghestan, and to 2nd June 1864 in the western part of the Caucasian range. The Russo-Turkish war of 1877-78 brought to Russia an increase of 2189 square miles of new territory to her Caucasian dominions. With the supremacy of Russia the Caucasus learned for the first time in its long history the blessing of durable and secure peace; and there is much hope for a country which rejoices in a long peace and complete security.

[1] *The Kingdom of Georgia*, London, 1888.

THE PROVINCE OF ELIZAVETOPOL.

(From the Transcaucasian Census of 1886, carried out by the Caucasian Statistical Commission.)

By Nicolas de Seidlitz,

Director of the Commission; Hon. Corr. Mem. R.S.G.S.

The Province, or Government, of Elizavetopol lies between the Caucasus Mountains on the north and the river Araxes on the south—a river which also forms the boundary of Persia. It includes the eastern portion of the Little or Anti-Caucasus, and the transverse spurs which jut out into the country watered by the river Kura and its affluent, the Araxes.

The triangular strip of country bounded by these rivers was, in former times, inhabited by Armenians and Albanians (Aggovans), whose territory extended up to the southern base of the Great Caucasus, with Berdaa, in the valley of the Kura, as their chief town. The Aggovans, whose descendants, the Udines, at the present day occupy the villages of Vartashen and Nish, were quoted by Strabo as the third great people of the Caucasus, the Georgians and Armenians being the others. The Aggovans, from confessing the same religious faith, became closely assimilated to their neighbours, the Armenians, but accepted Islamism after their absorption by the Tartars, who, at the present time, form 56 per cent. of the whole population, the Armenians numbering 35 per cent., and the Udines only 1 per cent. The Udines number less than the Russians, who first penetrated into the country in the year 1828, and very nearly five times less than the Kurds (4·6 per cent.). The Province of Elizavetopol covers an area of 16,847 English square miles. The density of population to the square mile is 43·2—the fixed population numbering 728,251.

In 1873 the inhabitants numbered only 593,784. The increase in 1886 of nearly 24 per cent. was distributed as follows:—Among the inhabitants of the towns, 11·36 per cent.; among the rural population, 25·55 per cent. This large increase during the last thirteen years is the result not only of natural causes, but also partly of the better methods of enumeration adopted by the Census. Neither emigration nor immigration introduced any notable factor. Of the total population, 72,994 live in the towns (Elizavetopol, 20,294; Nukha, 25,894; Shusha, 26,806), whilst the remainder are distributed among the following eight districts:—Elizavetopol, 102,594; Aresh, 51,845; Jebraïl, 46,402; Jevanshir, 54,950; Sangesur, 123,997; Kasakh, 84,888; Nukha, 91,119; Shusha, 99,462. The rural population thus numbers 655,257 souls. Consequently, rather more than 10 per cent. of the population live in cities, and nearly 90 per cent. in the country districts. The few and little-populated towns of the province possess none of the characteristics of town life. In Elizavetopol the suburbs are buried among large orchards and vineyards, and those of Nukha among mulberry plantations; moreover, the inhabitants of both these cities have large field-

under cultivation. Shusha, on the other hand, being situated on a high rocky plateau, and enclosed by stone walls, consists of closely-packed houses.

The population is composed of the following ethnographical elements —7921 Russians, 1896 Germans, 2909 Tats (Iranians speaking a Persian *patois*), 33,819 Kurds, 229,340 Armenians, and 227 Gypsies. Here all belong to the Aryan or Indo-European stock. In addition, there are 1750 Jews, who among themselves speak the Tat dialect, thus proving that their ancestors migrated to this country with the Tats from Persia, probably at the time when, during the reign of the Sassanid Shapur (Sapor) II. (309 to 381 A.D.), the Persian domination spread northwards along the shores of the Caspian. These Jews are the sole representatives of the Semitic race, and live together in the village of Vartashen, in the district of Nukha; they carry on agriculture, grow tobacco, and act as retail tradesmen. Moreover, there are 4192 Kurins and 1521 Haputlis, speaking a similar dialect; these are Lesghians, who crossed the main chain of the Caucasus, and now live chiefly in the adjacent districts of Nukha and Aresh. Belonging ethnographically to the east Caucasian highlands are 7273 Udines, who are distinguished by their ancient culture and some traces of historical record. Numerically the dominating nationality is that of the Adarbaidjan Tartars, who number 364,235 souls, or 56 per cent. of the whole population of the province; they have close blood-relationship with the Aryans (Armenians and Udines), particularly in the district of Nukha.

As regards the division of the population according to religious faiths, the Mussulmans number 61·8 per cent. (Shiites, 36·5 per cent.; Sunnites, 25·1 per cent.; Ali-Allahi, 0·2 per cent.). The Ali-Allahi profess an ultra-Shiite creed, by accepting Ali, the son-in-law of Mohammed, not only as his successor, like the Shiites, but in venerating him as a divine personality; hence their name of Ali-Allahi. They are not acknowledged by the other Mohammedans. They number only about 1925 souls, and live exclusively in the district of Jebraïl.

The geographical distribution of the Sunnites and Shiites has for the first time been accurately given in the map (10 versts to an English inch) accompanying our work on the results of the last census in the province of Elizavetopol, on the occasion of the introduction in 1887 of compulsory military service.

In the neighbouring province of Baku the Sunnites extend from Daghestan (a province which is inhabited exclusively by this sect) to the river Kura. The Shiites are found only on the shores of the Caspian, dwelling within a narrow zone as far north as Derbend. In the province of Elizavetopol the Kura likewise forms the boundary of these two sects. South of this river the inhabitants of the canton Samukh, in the district of Elizavetopol, are included among the Sunnites, and more or less considerable communities of them are to be found in the district of Kasakh, on the frontier of the Tiflis province, and in the district of Jebraïl, on the river Araxes. Isolated adherents of the Sunnite creed are also found on the right bank of the Araxes, who have survived the influence of the neighbouring Persians.

The Armenians in the province of Elizavetopol inhabit chiefly the slopes of the Little or Anti-Caucasus and the districts of Nukha and Aresh, and the steppe region of Boz-agh, which stretches in a parallel direction to the main chain of the Caucasus. The Tartars occupy the whole of the fertile plain of the Kura and the mountain districts behind the Armenians up to their alpine pasture-lands. This district promises to become in the near future a very productive wine-producing country, owing to the proximity of the Trans-Caucasian Railway.

Our census of the population brought out very interesting data respecting the numerical relationship of the male and female inhabitants of the province of Elizavetopol in respect of nationality. The province, in common with the whole of Cis- and Trans-Caucasia (with the sole exception of the northern half of Daghestan), belongs to the land zone—beginning in North and Central Asia (Siberia and Turkestan), and comprehending, besides the Caucasus, the whole of Southern Russia, Roumania, Transylvania, Servia, Greece, and Italy (apart from Sicily), the southern half of France, the valley of the Rhine, and Belgium—where, in contrast to the rest of Western Europe and European Russia, the male population exceeds the female. In the whole province of Elizavetopol the female population equals only 77·61 per cent. Divided according to nationality the female population bears the following proportion to the male population: Germans, 103·23 per cent.; Jews, 94·88 per cent.; Udines, 91·34 per cent.; Russians, 90·96 per cent.; Armenians, 82·79 per cent.; while the Adarbaidjan Tartars, who are so numerous, show a percentage of only 73·71. This disproportion is to be attributed—apart from errors in the census—to the oppression of women by the Tartars, more especially by the nomadic tribes; moreover, boys have far greater attention shown to them in their infancy.

As the data obtained by the census are far more complete concerning the male population than as regards the female population, which is merely numbered, it is only possible to group the male population according to age and nationality. As regards age, according to the generally accepted groups, we find that, though the nationalities differ little from each other, they present a contrast to the people of Western Europe. Taking the groups 0 to 15 years, and 16 to 20 years, the province of Elizavetopol shows an increase over the corresponding European statistics, but a decrease from the age of 21 onwards, which is still more marked in the groups from 60 years and upwards.

This hasty sketch of the census, though confined only to the province of Elizavetopol, might be extended to the other provinces of the Caucasus by means of the data already collected, but I do not expect the whole work will be completed before 1890.

GREAT BRITAIN AND PORTUGAL IN EAST AFRICA.

By James Stevenson, F.R.G.S.

To the carefully prepared paper of Professor Batalha Reis, there are considerations to be added which will assist in forming a sounder opinion on the claims of Portugal in Nyassaland. Portugal had for a long time been in the position of a power that has abdicated, but, especially in those parts of the country where our countrymen are to be found, she at no time exercised authority or held posts. In the fourth decade of this century, the working population of the province, including the native agriculturists and gold miners, were sold off to Brazil. The statistics of the export of slaves during those years indicate the large drafts that were made upon the industry of the province. Subsequently the Government had to retreat from Zumbo and the Upper Zambesi, and maintained itself only in the forts at Tete and Sena, the Landine Zulus making raids at their pleasure upon all outside these forts. The functions of government were reduced to sending convicts to Quilimane and the other coast towns, and preventing the route between Quilimane and Tete and Sena from being permanently blocked.

Professor Reis in his paper further illustrates the position by showing that while Government exploring expeditions were sent out in 1798, in 1806 to 1811, and 1831 and 1832, after that time they ceased for more than half a century.

He also shows that trading expeditions continued to visit the Shiré valley for some years; and that, as late as 1853-1854, the trader Da Silva and Silva Porto's native servants passed across the district. But, some years after, a demand for slaves having sprung up for the French Colony of Bourbon, the Shiré valley was desolated and the inhabitants sold. As the leader of the caravan of slaves stopped by Livingstone was a well-known servant of the Governor of Tete, men of high position seem to have been implicated. The raids—as ruthless as any perpetrated by Arab banditti—were under the leadership of Portuguese half-castes. At this juncture a body of Livingstone's warlike Makololo, who had preferred not to return to their own country, restored order in the desolated regions and became the chiefs. Livingstone himself, at the head of an expedition sent out by the British Government, on which about £30,000 was spent, was accredited to the chiefs and people of that part of Africa, and was engaged for several years in entering into relations with the people of the Upper Zambesi, as well as with those of the Shiré valley and the Nyassa.

As has been stated, this was the only Government expedition sent to these parts for more than fifty years. When our countrymen some twelve years after its recall, began to occupy the Shiré valley and Lake Nyassa, the Government of Portugal fixed the confluence of the Shiré with the Zambesi as the point beyond which transit duties alone were to be levied, indorsing in this way the view of our Government that the races to the northward were independent. From Professor Reis's paper it is clear that their connection with these countries by trade or otherwise had ceased for about twenty-five years when the Portuguese settled this.

The remarks of Professor Reis as to the financial sacrifices Portugal has made for the maintenance of her position in East Africa must be taken in connection with the events above mentioned. A very high price was obtained for slaves in Brazil when the gold mines were opened; every one sold slaves, and Government got an export duty of $18 or about £4 sterling per head. If the parting with the population of the Zambesi valley reduced the province to a skeleton, and caused great expense from deficiency of revenue, it indicates that you cannot sell the population and retain effective possession of the country.

The expense of late years has been in a great measure caused by the necessity of asserting supremacy over the Landine Zulus, who had for so long a time kept the province in subjection, but a valuable province south of the Zambesi has been carved out of their territory, and the most recent expeditions have been supplied with recruits from among them.

Things were settled but for a few years when a Portuguese, who had acted as our Consul at Quilimane, having been kindly taken up the rivers on an excursion to Blantyre, the colonials became excited about the fine country occupied by us, and a short time afterwards a half-caste was found making war upon the Makololo chief near the mouth of the Shiré. Then the Governor appeared on the scene, and an attempt was made to tax the Machingiri inhabiting the left bank, which resulted in war with them. In the course of it the custom-house arranged for with the British Governmen was destroyed, and from that time constant excuses have been made for not replacing it, while provincial instead of transit duties have been charged, notwithstanding earnest representations as to such injustice.

When the Congo Treaty was being negotiated, the two Governments agreed that this custom-house should be placed at the confluence of the Ruo with the Shiré about 100 miles up the latter river. This treaty had the fate of being rejected not because it was politically inexpedient, but because it stood in the way of the plans of a Portuguese subject who became Secretary of the amalgamated Lancashire Companies who proposed to trade on the Congo.

In order to get first his principals, and through them the Chambers of Commerce, to influence the House of Commons to throw out the treaty, they had to be indoctrinated with very advanced views as to Portuguese inefficiency. To get the treaty thrown out in this way, and to dispose of his extensive factories on the lower Congo and the Atlantic coasts before the Berlin Congress threw them out of the line of trade, was a triumph of diplomacy on the part of the secretary. The Lancashire Companies deserved to lose, but it was hard upon the African Lakes Company to be exposed to all the loss and embarrassment of recent years, by the upsetting of the arrangement under which they were trading on the Zambesi and Shiré, which were an integral part of this treaty. This second arrangement having fallen through, something might be said in favour of reverting to the original arrangement,—that the transit duties should take effect from the confluence of the Shiré and Zambesi.

Professor Reis mentions the recent expeditions of Serpa Pinto and the two Cardosos in the same lines with those of the first part of the century without specially calling attention to the interval of fifty years

which divides them. In this interval the status of slavery was rendered illegal in Portuguese possessions, but nevertheless, the facilities accorded to Serpa Pinto were in connection with the slave-trade, which had to a certain extent been diverted from Kilwa and Lindi to Ibo previous to 1885. The subsequent expeditions of Cardoso approached Nyassa by the route over which the Arab banditti came to Borôr, near Quilimane, for supplies of arms and ammunition for slave-raids in the interior. The chiefs near Lake Nyassa who received them were generally those who were implicated in the slave-trade, and stand aloof from our countrymen, knowing their disapproval.

In conclusion, Professor Reis has quite failed to make out any claim of Portugal to occupation either in the Shiré valley or in Nyassaland. Further, although there has been recent occupation south of Sena, and extending to the coast, Montagu Kerr, who is quoted by Professor Reis, found no trace of Portuguese occupation in 1884, in his approach to Tete from the south-west, and in his journey from Tete northwards.

Besides its rejection by the contrivance of a Portuguese subject, as the arrangement made under the Congo treaty that the limit of the Portuguese province should be advanced to Nokki, on the lower Congo, holds good to the present day, having been confirmed under the arrangements subsequent to the Berlin Congress, there is no ground whatever for the popular idea prevalent in Portugal that Great Britain, having injured Portuguese interests on the Congo, should make room for her in East Africa. The corresponding limit in East Africa at the Ruo branch of the Shiré should be confirmed, otherwise that at the confluence of the Shiré with the Zambesi, of which it was an adjustment, stands good.

As part of the plan at present being worked out is said to be that Jesuit missionaries are to take up their position near the Protestant missions in Nyassaland, it seems as though the Jesuits, who have been more prominent in Portugal since the misunderstanding with this country, were taking the opportunity of pushing their own plans by getting countenance given to the slave-dealers who have attacked our countrymen. The plan of employing half-castes nominally to control tribes that were really independent was unsuccessful, and injured the prestige of Portugal. To give countenance to the slave-trade, when the public opinion of all civilised nations is rising against it, would be an equally mistaken policy. Meantime, the chief effect of the disturbance of previous settlements has been to raise the question whether Portugal is really entitled to levy transit duties on the Zambesi, which might have been of considerable value if the interior were fully developed.

EXAMINATION SCHEME OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Examination was held on Saturday, March 2d, at Edinburgh, Aberdeen, Nairn, Aberlady, Craighead, and Gersa.

Copies of the Examination Papers were sent from Edinburgh, and the examination at each centre was superintended by members of the Society and others.

The following Syllabus was issued by the Committee some months before the examination :—

1. *Form and Size of the Earth. Day and Night. Time. The Seasons. The Mariner's Compass. Latitude and Longitude.*

2. *The Meaning of Terms used in describing the features of the Land (with Rivers and Mountains) and of the Sea.*

3. *The Meaning of a Map, and the representation of Land and Sea features thereon.**

4. *The Drawing of a small Sketch Map from description given.†*

* Reference should be made to the Ordnance Survey Map of the district in which the school is situated.

† Reference may be made to the Introductory Chapter of Keith Johnston's *Physical and Descriptive Geography.*

The Examination Papers, prepared by Mr. F. Grant Ogilvie and Mr. William Jolly, were as follows :—

SENIOR PAPER.

(FOR CANDIDATES OVER THIRTEEN YEARS OF AGE.)

Time allowed—Three Hours.

1. In what astronomical phenomenon can the form of the earth be observed with our eyes? Explain shortly how this is a proof of its form.

2. How many degrees are the Polar Circles from the Poles and the Equator? Why are they at that distance? Give their names and positions.

3. Why are the lines of latitude called "parallels," and not the lines of longitude? What are lines of longitude called, and why?

4. At our winter solstice—What is the exact position of the twilight circle of the earth's shadow? Where is it shortest day? Where longest day? Where is the Sun directly overhead? What of day and night at the North Pole? Give reasons in each case.

5. Describe shortly, with reasons, the method by which a sailor discovers his longitude by means of a chronometer.

The following four questions (6, 7, 8, *and* 9) *refer to the portion of country shown in the accompanying map.*[1]

6. You are at Hunthall, and have to reach Crieff Junction in one hour and a half. Can you do this by walking steadily at four miles an hour? (Show how you find out.) Give a short description of the road and its *immediate* surroundings as far as the map shows these.

7. Draw on the map marked "to be returned," the lines of water-parting separating the three drainage-areas, Devon, Ruthven Water, and Allan Water.

8. Draw a section from Tulliebardine Mill through the top of Weatherhill to the river Devon.

9. Give a short general description of the physical features of the portion of country in the map—(*a*) if the sea-level rose 500 feet; (*b*) if the sea-level rose 1000 feet.

[1] See Map issued with this number of the *Magazine.*

10. Draw a sketch-map from the following notes—scale 200 paces to 1 inch. A scale of inches is given below, and may be detached for use in drawing the map. Letter-names are given to places for convenience of reference.

General View and Observations from M.—(It will be noted that only a few bearings can be put in the map at this point.)—To get a general view of the section of country to be mapped I go to the top of a low mound (M), and from that position I make the following observations:—A curved ridge bounds the eastern and south-eastern horizon; the two highest points (A and B) of this ridge bear respectively ENE. and SE. Due east from M a road passes along the northern side of a valley which intersects the ridge. From this valley there issues a stream (R), which further down receives one tributary (H) from its left bank, and then another (K) from its right bank. A village (V) bears NNE. from the mound; a road leads from the village directly towards the mound, but at a short distance off it bends so as to pass by the east side of the mound. This road crosses the stream (R) by a bridge between the bend and the village. In a line NE. from the mound I see a bridge by which another road crosses the tributary (K), and beyond that a farm (F) at the base of the northern portion of the ridge. The point at which K enters the main stream bears NE. by N. from the mound.

On the way from M to P.—I now descend the eastern slope of the mound and find the road 100 paces from the top of the mound. Here the main road to the village comes from S. by W., and passes NNW. to the bend above referred to. From my present position a side-road strikes due east to the valley in the ridge. I take this road, and 350 paces along it I reach the point where the tributary (H) goes under the road; it comes from S. by E., and after passing the road flows NNW. till it joins the main stream. Close to the south side of the road, and the west bank of H, there is a mill and miller's house. A wood is bounded on the west by the upper portion of H, and on the north by the further continuation of the road from the mill to the point (P) where the road enters the valley; this distance I measure, and find to be 300 paces.

Observations taken from P.—Taking my stand at P, I make the following observations:—The point B of the ridge bears SW. The line to this point forms, roughly, the boundary of the wood, the trees at this part being rather scattered. The main stream R passes under the road at P, and thence WNW., receiving the tributaries H and K, and passing under a bridge on the road from the mound to the village. A road leads from P north-west to the village, crossing K by a bridge. The farm F is due north of P, and the peak A, NNE.

Inches.

JUNIOR PAPER.

(for candidates under thirteen years of age.)

Time allowed—Three Hours.

1. How is it that the waters of the ocean do not fall away from the surface of the earth at the antipodes?

2. How many degrees are the Tropics from the Equator and the Poles? Why are they at this distance? Give their names and positions.

3. When it is summer in Britain—Where is the sun shining directly overhead? Where is it winter at the same time? Why is it winter there?

4. What is a Meridian, and why is it so called? How do meridians run? Why is it necessary to fix on a "first meridian"?

5. Define an isthmus, a plateau, and a watershed; giving an example of each and showing how it illustrates the definition. Give also a simpler name for each of these three terms?

The following four questions (6, 7, 8 *and* 9) *refer to the portion of country shown in the accompanying map.*[1]

6. How many miles is it by road from Auchterarder Church to Blackford Church?

7. What is the greatest length of Tulliebardine Wood?

8. What part of the country shown may be described generally as "high ground"? What part as "low ground"? Tell what places are actually the highest and the lowest?

9. Draw a section from Weatherhill to Eastbowhill; *or, if you cannot draw a section*, tell the ups and downs of a walk from Weatherhill to Eastbowhill.

10. Draw a sketch map from the following notes. Scale 200 paces to the inch. A scale of inches is given below, and may be detached for use in drawing the map.

The road in front of the school and play-ground lies NE. and SW.

Starting from the play-ground gate, I turn to the left along the road to the NE. At 200 paces I find the road divides; one part leading due N., the other due E. In the angle between these two stands the church, and behind it there is a wood. I go by the road to the E., and at 300 paces from the corner, I come to the further edge of the wood, which I find to be bounded by a stream flowing from NNW. This stream passes under the road by a bridge, and thence south, to join a river. From the bridge I see a farm bearing NE. Continuing along the road for 400 paces further, I find on the left hand a side road leading due N. to the farm, and on the right a steep bank running down to a bend of the river, the river bank being about 20 paces from the road. The river here seems to be about 40 paces broad, and while it winds a little, its general direction below the bend is about SW., above the bend about ESE.

INCHES.

RESULTS.

The total number of candidates examined was 147, from seven schools.

(A.) *Senior Examination.*

I. The following 14 candidates received First-Class Certificates and Prizes:—

		Per cent.
1	Peter Smith, Robert Gordon's College, Aberdeen,	89
2	R. Candlish Bannerman, do.	83
2	John L. Skene, do.	83
4	William Laing, do.	82
5	Charles I. Beattie, do.	81
5	Alexr. Dick, George Heriot's Hospital School, Edinburgh,	81
5	James Alexander Murray, do.	81
8	John Burns, Nairn Academy,	80
8	Grieve D. Grierson, George Heriot's Hospital School,	80
8	Michael Oldham, do.	80
8	Alexr. Taylor, Robt. Gordon's Col.	80
12	Guy Westwood Boyd, do.	79
12	Charles Ritchie, do.	79
14	Ernest F. Bashford, George Heriot's Hospital School,	78

[1] See Map issued with this number of the *Magazine*.

II. The following 8 candidates received First-Class Certificates :—

	Per cent.
Frank Brebner, Robert Gordon's College,	77
John Graham Callander, do.	77
David H. Henry, George Heriot's Hospital School,	77
Alexander Calder, Robert Gordon's College,	76
P. Hardie, George Heriot's Hospital School,	76
James P. D. Baird, do.	75
Andrew M. Malcolm, Robert Gordon's College,	75
George Rattray, do.	75

III. The following 78 candidates received Second-Class Certificates :—

From Robert Gordon's College, Aberdeen.

Beattie, Robert.
Burr, John.
Cheyne, George.
Cooper, George.
Cruickshank, Alex.
Davie, Alex.
Durno, George.
Falconer, Alexander.
Forsyth, George G. S.
Fraser, Thomas.
Gibbon, John M.
Gray, Henry J.
Halley, John S.
Hemphill, Robert.
Hendry, A.
Howie, John W.
Hynd, A. J.
Keenan, James.
Leslie, Robert M'B.
Martin, Ephraim.
Matthew, John C.
Mitchell, A. Geddes.
Moir, John.
Nicol, John.
Pickford, James.
Rae, William.
Reid, Alexander.
Robertson, James W.
Robertson, John.
Robertson, Lawrence Don.
Roger, James P.
Sangster, Arthur.
Smith, Alick.
Smith, Hugh.
Smith, Robert D.
Souter, Thomas W.
Spalding, R.
Stephen, Lessel P.
Stewart, George.
Stewart, William.
Strachan, J.
Thom, James.
Tindal, James W.
Troup, George A.
Watt, Patrick.
Youngson, Peter.

From George Heriot's Hospital School, Edinburgh.

Anderson, J. G.
Bathgate, Alexander P.
Bashford, C.
Blanchard, W.
Bowie, Robert.
Clark, Alexander.
Clark, Duncan.
Clark, James.
Easson, James.
Ednie, George.
Gardiner, Frederick.
Gordon, William.
Henderson, John M.
Lindsay, William.
Middleton, James R.
Miller, R. B.
Minty, Frederick C.
Morrison, R. A.
M'Ara, Andrew.
Peden, E. J.
Prince, Simon.
Russell, Geo. R.
Scott, Alexander R.
Stenhouse, James.
Winlaw, Geo. A.
Zoblinsky, Albert O.

From Charlotte Square Institution.

Dennison, Bessie. | Dennison, Jane. | Kennedy, Jessie S.

From Nairn Academy.

Morrison, Donald. | Michael, A. | Tolmie, James.

(B.) *Junior Examination.*

I. The following candidate received a First-Class Certificate and Prize :—

Andrew N. Meldrum, Robert Gordon's College, Aberdeen, 87 per cent.

II. The following 2 candidates received First-Class Certificates :—

James Gould, Robert Gordon's College, Aberdeen, 78 per cent.
William Johnston, Aberlady School, . . . 75 „

III. The following 4 candidates received Second-Class Certificates :—

R. D. Angus, Robert Gordon's College, Aberdeen, 72 per cent.
Gordon Ogilvie, do. do., 71 „
D. D. Lamb, Nairn Academy, ... 61 „
Annie C. Lee, Craighead Public School, . . 50 „

The Books awarded as Prizes were presented to the Committee by the following firms :—

Messrs. John Bartholomew and Co.
Messrs. A. and C. Black.
Messrs. Blackie and Son.
Messrs. W. Blackwood and Sons.

The following is the Report of the Examiners on the whole Examination and the results :—

EDINBURGH, 15*th May* 1889.

DEAR SIR,—The results of the Examination in Geography which we have conducted for the Society are given in the accompanying papers.

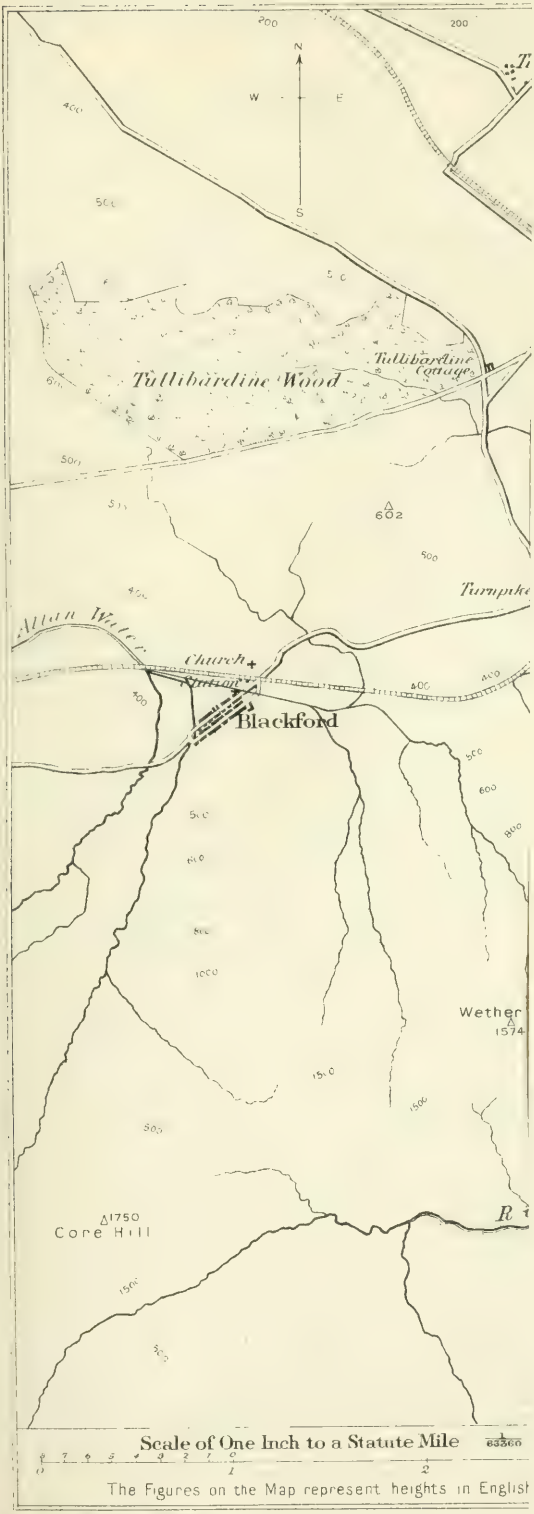
The separate Paper set for Junior Candidates was arranged so as to be suitable for pupils in the Junior Departments of Secondary Schools and the Advanced Departments of Public Elementary Schools. It is not a little surprising that so few candidates presented themselves for examination in this stage ; although the standard reached by almost all of them shows that an excellent basis for higher geographical study may be laid even in junior classes.

The Senior Paper presents no new features, and we find the answers on the whole satisfactory. Many of them give evidence of thorough, realistic teaching in Physical Geography and of careful training in the use of maps.—We are, dear Sir, yours faithfully,

F. GRANT OGILVIE.
WILLIAM JOLLY.

W. Scott Dalgleish, Esq., M.A.,
Convener of the Education Committee
of the Royal Scottish Geographical Society.

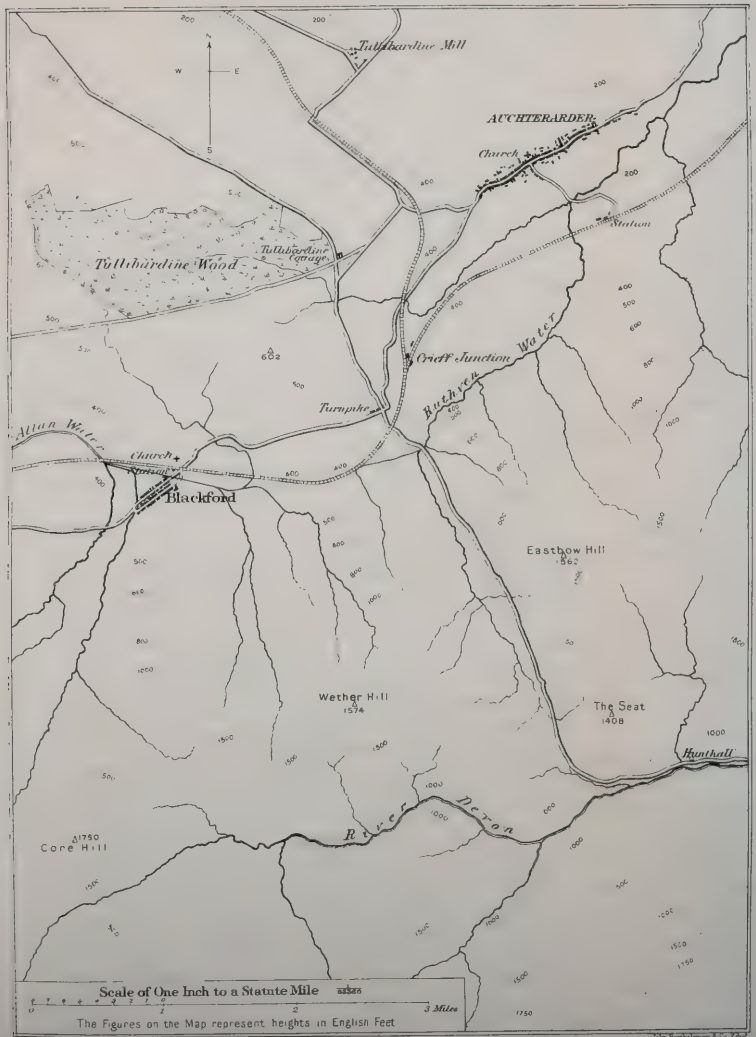
MAP FOR E



The Edinburgh Geographical Institute

Royal Scottish Geo

MAP FOR EXAMINATION.



Royal Scottish Geographical Society. 1889

GEOGRAPHICAL NOTES.

EUROPE.

Russian Cartography.—In the *Revue de Géographie* for April last M. Venukoff has traced the progress of Russian cartography from its origin in the sixteenth century up till now. The first map of the Russian dominions was prepared by an Italian, B. Agneze, from information given him by an envoy sent by the Tzar Wassili to Pope Clement VII. The MS. of this map, which was never engraved, was discovered in 1884 in the library of St. Mark's at Venice. It is dated 1525. Twelve years after Agneze, A. Wid, a Lithuanian by birth, and a Senator of Dantzic, constructed a fairly good map of all Russia, with a part of Siberia. The famous Munster map, dated 1544, was based on this, but it was smaller, and not so correct. Another edition of Wid's map was published at Amsterdam in 1557, and five years later Jenkinson's map, remarkable for the number of its details, appeared in London. In this map Tartary was included. At the end of the century the large general map of Russia, known under the name of *Bolchoïtchertège* (grand design) made its appearance. It embodied the results of the explorations which had then for the first time been made in Siberia. This map, which has disappeared, formed very probably the basis of that which was prepared by Theodore, the son of the Tzar Boris, and published by H. Gherard in 1614. It was exact enough, though but little use was made of astronomical data in its construction. It has, however, meridians and parallels—the latter at an equidistance of 87 versts—a circumstance which proves that at this epoch the Russian verst was longer than in our days (104·6 to the degree). In the latter half of the seventeenth century some maps of importance were published, as those of Olearius, Rémésoff, and Witsen, the friend of Peter the Great, in whose reign European methods were for the first time introduced into Russian cartography. Attempts were then made to determine the position of places by means of astronomical observations, and for this purpose a small band of experts in geodesy was formed who prosecuted their labours under the direction of the celebrated Behring. They were sent into Asiatic Russia, where they were engaged from 1725 to 1740 in mapping that country. They were joined by two famous French geographers, Joseph and Louis Delisle de la Croière, who took under their charge the astronomical observations, and the management of an establishment for map-making connected with the St. Petersburg Academy of Science. This establishment, which existed till the end of the eighteenth century, published in 1745 an atlas of the Russian Empire consisting of 19 maps, of which six were Asiatic. Several officers of the Russian navy about the same time contributed important charts, such as those of the Caspian, the Baltic, the Black Sea, and the Sea of Azof. During the first half of the eighteenth century the most distinguished of all the Russian cartographers was the indefatigable Kiriloff who, if he had possessed sufficient mathematical knowledge, might have been another Ortelius, or the D'Anville of Russia.

It was the Empress Catherine II. who laid the foundation of exact cartography in Russia by prescribing topographical delineations in all the European provinces of her vast empire. These delineations, elsewhere superficial enough, were made by surveyors to mark off the landed properties of the nobility and of the rural communes. The towns also received their plans, which they could not alter in any one respect without the authority of Government. This work occupied many decades, but resulted in the construction of a good map of Russia

in 100 sheets, which, in spite of its defects, mainly attributable to the insufficiency of astronomical data, soon made all the old maps disappear from circulation. This was the map used by Napoleon in his invasion of Russia. All the maps in common use till the execution of the great geodetical and topographical labours of Generals Tenner and Schoubert, in the time of the Emperor Nicholas, were but copies of this map on a reduced scale.

The cartography of Siberia made great progress in the second half of the eighteenth century, thanks to the numerous scientific expeditions made into the country by members of the Academy of the Sciences, such as Gmélin, Pallas, Kracheninskoff, and others. Attention was at the same time turned to the vast mining districts in the Ural, the Altaï, and the Russian Dauria, while navigation was rendered safer by the preparation of charts which were remarkable for their accuracy.

The great European wars in the early part of the present century interrupted for a space the progress of Russian cartography, but on the return of peace, a corps of military topographers under Prince Volkhinsky and General Schoubert prepared in course of time topographical plans of great accuracy which embraced the whole of European Russia and many of her Asiatic provinces. A grand triangulation also was commenced by W. Strouve and General Tenner in the western part of the empire, and was continued by them and by General Schoubert, till an arc of the meridian of 25° between the North Cape and the Lower Danube was measured with a precision leaving nothing to be desired. Other triangulations besides were undertaken and completed in many other parts of the empire, as, for instance, in the Caucasus, where Generals Khodzko and Stebnitzky have won by their labours a world-wide renown, while in many of the provinces, the most remote from the centre of Russia, maps were prepared from compass tracings, as of the Kirghiz Steppes, of the Altaï, and of the Transbaïkal province. Cartography, other than official, made no great progress in the first half of the present century, but on the other hand hydrographic maps of great importance were prepared and published. The period was signalised by the great voyages of the Russian seamen Krouzenstern, Golovnine, Lutke, and others, who published numerous charts of the seas which they navigated. Between 1819 and 1822 delineations of the north-east coast of Siberia were prepared by Lieutenants Anjou and Wrangel which gave a great impulse to marine cartography.

Under the direction of the famous geodetical expert, General Stebnitzky, such astonishing progress was made in the surveying and mapping of the Caucasus region that it may be asserted that this part of the Russian Empire, which was not finally conquered till 1864, is better explored, from a geographical point of view, than any other part except perhaps Poland. Two principal works executed since 1850 have attracted general attention; numerous sheets of the great topographical chart of European Russia, representing in relief the land of most of the western provinces, and the so-called special map of the whole of Eastern Russia on the scale of 1:420,000. This consists of 145 sheets, and represents all the villages and hamlets, without even omitting the number of houses they contain. It is drawn under two aspects, with and without forests.

Among other official maps the most generally interesting are those of the Asiatic portions of the empire, as, for instance, of the Transcaspian province, of Turkestan, of the Kirghiz Steppes, and of the border districts. The most popular is the general map of Asiatic Russia on the scale of 1:4,200,000, in which are represented parts of Persia, Afghanistan, India, Japan, and nearly

the whole of China. Matoussovsky's map of the Chinese Empire is perhaps the best to be found in Europe.

Since 1850, hydrographic cartography has made immense progress. Besides improved charts of the Russian seas there have been published charts of the great Russian lakes and rivers. The Geographical Society of Russia, founded in 1846, has published at its own expense many interesting maps, especially two ethnographic maps of European Russia, compiled by Koeppen, Rittich, and others. Numerous maps also have been published by the successive Ministers of the Interior relating to their special departments, the agricultural, industrial, and commercial maps representing the progress, material and intellectual, of the Russian people.

ASIA.

Trade Routes in Persia.—General Sir R. Murdoch Smith recently addressed the London Chamber of Commerce on "The Karún River and British Trade with Persia." In the course of his remarks, Sir Murdoch Smith said:—More than three-fourths of the whole area of Persia is an elevated plateau, whose plains are at an average height of 4000 to 5000 feet above the sea. This plateau, diversified and broken up by numerous mountain ranges, is *par excellence*, the distinctive feature of the country, and that on which its climate, its products, and its means of communication chiefly depend. To reach it, no matter from what side it is approached, a long and rugged ascent must be made. Once, however, the plateau is fairly reached, a comparatively easy road can generally be found from one part of the country to another, notwithstanding the many lofty mountains by which the plains are intersected. The climate is extremely dry, and the temperature somewhat excessive—that is to say, very warm in summer, and very cold in the more elevated parts of the country in winter. For the growth of the crops, the rainfall, except in a few localities, is insufficient, and has to be supplemented by means of artificial irrigation, of which an elaborate and ingenious system has been in use from the earliest times. The mountain ranges, with their superincumbent masses of winter snow, are the great natural reservoirs from which the irrigation channels derive their supplies. Hence it is, that where the mountains most abound, as they do in the west and south-west, there also the most luxuriant crops, the most abundant pasture, and the most numerous flocks are to be seen. On the other hand, the great plains of Eastern and Eastern Central Persia are more or less simple deserts. Wheeled vehicles are practically non-existent. The whole transport work of the country is done by beasts of burden—camels, mules, and donkeys—which are excellent and abundant. In a very mountainous country like Persia, this is, perhaps, not such a sign of backwardness as at first sight it may appear. It is very doubtful whether over such long, steep, rugged slopes, the cart or the wagon is really better than the pack-saddle, where plenty of suitable beasts of burden are to be found. Otherwise than by railways, it is difficult to see how this primitive method of transport is to be much improved in the belt of mountainous country which surrounds the table-land. Ordinary carriageable roads, unless laid out with easy slopes, and therefore very expensive to construct, would in my opinion be of little or no use. It is rather in the plains, both above and below this belt, that improvements in the existing method of transport are to be looked for, at all events for the present. On most of the old-established highways (which, I may remark, are merely mule-tracks) caravanserais for the accommodation of travellers and caravans are to be found. During the greater part of the year, however, shelter is unnecessary, so

that the absence of caravanserais on any particular road is no actual bar to the passage of caravans. As a matter of fact, large mercantile caravans are in the habit of bivouacking in the open air in preference to making use of caravanserais. Water is the only absolutely indispensable requisite on a Persian trade-route, for even forage can be carried for moderate distances. Where, however, this has to be done, either by the caravans themselves or by other people for the purpose of selling forage to caravans as they pass, the cost of the transport of merchandise is proportionately increased. The rate of mule-hire depends, therefore, not only on the number of mules available and on the distance to be traversed, but also on the nature of the country. Where natural pasture is to be had, short daily stages are made, and consequently long daily halts, during which the animals are turned out to graze and pick up their living without expense to their owners. In estimating the advantages or disadvantages, *i.e.* the cheapness or dearness, of any particular route for the transport of merchandise in Persia, the nature of the surrounding country in respect of water and forage must consequently be taken into account as well as the actual distance in miles. The routes by which Persia now communicates with the outer world may be conveniently divided into two groups, viz., those leading to the Caspian and Black Sea on the north, and those leading to the Persian Gulf on the south. On those which abut on the Caspian, at all events at their northern extremities, Russia has a monopoly of the foreign trade, there being no means of egress from the Caspian other than through Russia. To the Black Sea, the old caravan route from Teheran, *via* Tabreez, Erzeroum, and Trebizond, is still made use of to a considerable extent; but it cannot long be expected to compete successfully with the parallel route through the Caucasus, now that there is railway communication the whole way from Batum on the Black Sea to Baku on the Caspian. The railway, however, is useless for all merchandise but Russian, inasmuch as the free passage of goods in transit formerly conceded to the Caucasus has been withdrawn, and the normal prohibitive customs tariff of the rest of Russia imposed instead. . . . Let us now turn our attention to the other group of trade-routes with which we are more immediately concerned, those, namely, which lead to the Persian Gulf. Here we find the great natural highway of the Tigris, navigable for steamers as far up as Baghdad, whence the plateau of Persia can be reached, *via* Kermanshah, by a comparatively easy ascent. This route, however, has the great defect of passing through foreign territory, as the whole course of the Tigris lies within the Turkish dominions. Turkish custom-houses consequently intervene on this route between the Turkish frontier and the sea. The use of this great natural highway for British trade is further restricted by the fact that the Turkish Government only allows two English steamers to navigate the river, although twenty might be employed with advantage. There remain to be noticed the routes into the interior of Persia from Bushire and Bunder Abbas, of which only that from Bushire need now occupy our attention. Bunder Abbas, situated at the mouth of the Persian Gulf, far to the eastward, is of little importance compared with Bushire, and has no trade connection with those portions of Persia with which we are concerned on the present occasion. Bushire is practically the only free outlet of any importance for her produce which Persia has to the outer world, and in many respects it is an extremely inconvenient one. The harbour is merely an open roadstead, at a considerable distance from the landing-place, with which in rough weather it is difficult and sometimes impossible to communicate. The road into the interior to Shiraz, distant about 200 miles, lies over a succession of rugged mountain-passes, and is one of the most difficult in the country. Beyond Shiraz no

place of importance is met with until Ispahan is reached, at a distance of about 320 miles, *i.e.* 520 miles from Bushire. From Ispahan, formerly the capital of Persia, and still a large and important city and the centre of a rich district, roads radiate to Yezd and Kerman on the east; Kashan, Koom, and Teheran on the north; Hamadan and Kermanshah on the west; and Shiraz on the south. It is situated in the very heart of Persia, and is one of its principal trade centres. It may, therefore, be taken as a convenient testing-point from which to regard the present route from Bushire and the prospective one by the Karún. The Karún rises in the high uplands of Chehar Mahal, to the south-west of Ispahan. After a rapid descent, it emerges from the mountains on the low alluvial plains near the town of Shushter. Here it divides into two branches—the Karún proper to the right; and the Ab-i-Gargar, of artificial origin, to the left—which reunite some thirty miles lower down at Bend-i-Kir. Here the reunited Karún is joined on its right bank by an affluent, the Diz, which descends from the highlands to the westward of the upper valley of the Karún, and passes the large town of Dizful, where it emerges on the low alluvial plain. Thirty miles below the confluence at Bend-i-Kir of the three streams, an outcrop of sandstone rocks crosses the bed of the river at Ahwaz, causing a short succession of rapids, to which I shall presently more particularly refer. From Ahwaz, the Karún flows placidly across the plain for a further distance, measured as the crow flies, of seventy miles to Mohammerah, where it joins the Shat-el-Arab, or tidal estuary of the united Tigris and Euphrates. From Mohammerah to the sea, a distance of about forty miles, the Shat-el-Arab is navigable for ocean-going steamers. From Mohammerah to within a mile of Shuster, on the Ab-i-Gargar branch, a direct distance of about 130 miles, the Karún is, with the exception of the single obstacle at Ahwaz, admirably suited for steam navigation the whole way. Combined with the Shat-el-Arab, into which it flows, it thus forms a great natural navigable highway, which penetrates 170 miles into the heart of the country. Nor is this all. A glance at a map will show that the configuration of the Persian Gulf is such that the further up the gulf you go, especially after you pass Bushire, the more you approach the centre of Persia. This fact must, therefore, be taken into account in estimating the value of the Karún route. The end of the Karún navigation at Shuster is nearer to the central parts of Persia than Bushire is, not only by the 170 miles of river and estuary, but also by the 150 miles of sea between Bushire and the mouth of the Shat-el-Arab. In other words, 320 miles of water-carriage may, by means of the Karún route, be substituted for as many miles of pack-saddle transport by the Bushire one.—*Chamber of Commerce Journal*, vol. viii. No. 85.

AFRICA.

On the Scientific Results of Dr. W. Junker's Explorations in Central Africa—Part II.—In our February number (page 100), we gave a notice of the first part of Dr. Junker's valuable report. Messrs. Justus Perthes, of Gotha, have now sent us the conclusion of the scientific results of Dr. Junker's journey in Central Africa. It forms the *Ergänzungsheft* No. 93, of *Petermann's Mitteilungen*, and is accompanied by two large maps (1:750,000), compiled by Dr. Bruno Hassenstein, representing the northern districts through which Dr. Junker passed. We need only say that these maps are as excellent as those published in the first part, and not only are Dr. Junker's routes depicted in great detail, but the routes of fifteen other explorers are also drawn on the maps. Thus, for the first time, we have a complete and detailed survey of the district between 5° and 8° N. latitude and 24° to 32° E. longitude. The first thirty-four pages of this publication

contain the conclusion of Dr. Junker's meteorological observations and determinations of altitudes. These observations have been compiled by Dr. Adolf Schmidt of Gotha, and the work has been very well done. It is, however, not exhaustive, and, as Dr. Schmidt himself says, many and most interesting problems which are contained in the observations have still to be worked out. But quite sufficient material is given to afford an insight into the general climate of the country, and when placed side by side with the meteorological data of other observers in Central Africa, a comprehensive idea may be obtained of the meteorological conditions of the central regions of the continent. Practically, the description which Hann has given in his *Handbuch der Klimatologie* (p. 270) has been fully corroborated by these observations.

The third and concluding chapter of this contribution is written by Dr. Bruno Hassenstein, and contains a full account of Dr. Junker's maps, together with some remarks upon Emin Pasha's routes, and references to the work of previous observers.

It would serve no good purpose to enter upon a general description of Dr. Hassenstein's remarks. It will be more useful to give an account of the method by which Dr. Junker has made his observations, as it will be of interest to the general reader, and it will also show the extraordinary patience with which the traveller has worked. In the first place, we may remark that in four years he marched some 2000 miles on foot. It was his habit to make his notes in little pocket-books, and at the end of each day's march to copy them in pen and ink into his journal, and at nearly all his camps he had the opportunity of taking the bearings of distant hills, thus forming a very good basis for correcting any error which might creep into his route observations. All Dr. Junker's routes are based on observations taken every five minutes during his marches, at the end of each five minutes the direction in which he had marched was entered in his note-book, and at the end of each march a calculation was made of the time marched, and the average direction of the march, the various halts on the road being carefully eliminated. For instance, on the 2d of January 1881, Dr. Junker started at 11 A.M. from Lacrima, and arrived at his camp at 4.35 P.M. In the note-book we find twenty-six notes giving time, twenty-six giving the number of minutes between each observation, and eighteen readings of the compass. At the end of the day we find noted that he had marched four hours forty minutes, had halted one hour twenty-five minutes, that the average direction in which he had travelled was W. 34° N., and that the length of the march in a straight line was three hours seventy-five minutes. Dr. Junker reckons that he marches 3·1 miles an hour. Apart, however, altogether from these observations, there are notes on the nature of the country marched through and its vegetation, the character and density of the population, the political boundaries crossed, the names and directions of the streams and rivers forded, their breadth and depth, and, where possible, a note as to their connection with other rivers. In conclusion, we have the readings of the thermometer and aneroid, as well as general remarks on the events of the day. We think that all must admit that rare enthusiasm must have inspired Dr. Junker to carry out work in such detail and with such immense perseverance for so many years.

Now that Dr. Junker has given to the world a summary of his scientific work in Africa, we shall look forward with lively interest to the publication of his journals. This publication is already appearing in Germany in parts, which are profusely and beautifully illustrated, and, from the few numbers we have seen, they seem to promise both a remarkable and popular book.

Survey of the Kassaï.—The survey by Captain Thys of the Kassaï and of the lower Lulua from Kwamouth on the Congo till beyond the station of Luebo forms the first great cartographic work relating to the Congo territory for which thanks are due to the Belgian officers of the Congo State. The survey of the course of the river was made from the steamer *Stanley* by means of the compass without the fixing of separate points relatively to determined positions. The map, which is constructed on the scale of 1 : 200,000 (Brussels : Inst. Natl. de Géogr.), will prove of essential service for the navigation of this mighty stream, since all the dangerous points are minutely specified upon it. This survey is not meant for direct transference into the maps of Africa. Thys's chart is not in special agreement with the survey made by Dr. Wolf of the stretch of the river from the mouth of the Sankuru to Luebo. That it could not be otherwise will be evident enough if we take into account the difficulty of river surveys of this nature, especially when the current is often tortuous and the waterway dangerous. It is to be hoped that a survey of the Congo itself is soon to follow. Captain Thys takes the altitude of the mouth of the Kassaï to be 287 mètres ; but from the meteorological observations which were registered from a quicksilver barometer at Kwamouth from 4th November 1886 to 7th March 1887, by the Catholic missionary Schmitz, the altitude of the station is given at 330 mètres, and the river-mouth at 305. The observations in question were calculated by Dr. A. von Danckelman (*Zeitschr. Ges. f. Erdk.*, Berlin, 1888, p. 432), who found the result as stated—since, on the stretch between Kwamouth and Stanley Pool the fall of the Congo is very considerable—also a confirmation of the estimate of the altitude of Stanley Pool at 280 mètres.—*Petermann's Mitteilungen*, 35 Band, 1889, I.

AMERICA.

The Rio San Juan de Nicaragua.—In the *Bulletin* of the American Geographical Society for the quarter ending March last, Civil Engineer R. E. Peary of the United States Navy describes this river, which is destined, with Lake Nicaragua, to form an ocean highway from the Caribbean Sea to the Pacific Ocean. Mr. Peary was a member of the United States Government Expeditions of 1884-5 and 1887-8. He reminds us that in 1851 an American company began running steamers up the Rio San Juan and across Lake Nicaragua, and in the next few years carried thousands of passengers and large quantities of treasure across the isthmus, and that there is now plying on Lake Nicaragua an American-built steamer which steamed up the river to the lake. This is, however, a small steamer ; whereas, by damming and deepening the river, and by means of two small canals, large ships will be enabled to sail across from sea to sea. The Rio San Juan presents many interesting features to the naturalist and sportsman. Alligators and sharks dash through its waters ; deer, wild pigs, and monkeys, white and blue herons, macaws, parrots, and parroquets enliven its banks. The scenery of the river is exquisitely beautiful. As to the healthiness of its valley, it is as healthy a locality as any in Nicaragua, or (the author adds rather vigorously) "any other country." The day-temperature is often hot (85° to 90°), but the nights are invariably cool. Even the mosquitoes are not persistent tyrants. Mr. Peary writes enthusiastically of the Rio San Juan, and predicts that, unless all signs fail, the time is close at hand when "the San Juan and Lake Nicaragua will be alive with white sails and the throbbing propellers of a mighty traffic." [We understand that the steamer *Alvena* recently left New York for Greytown with fifty men, and with materials for beginning work on the ship-canal from Greytown to the Rio San Juan. Piers, stores, and offices will be built at Greytown as a preliminary to the digging of the canal.]

NEW BOOKS.

Gleanings from Japan. By W. G. Dickson. Edinburgh and London: W. Blackwood and Sons, 1889. Pp. x+400. *Price* 16*s.*

Although much has been written about Japan since it was opened to foreign commerce, and its roads to foreign travellers, there is evidently a good deal of interesting matter, which, passed over by former writers, can be gleaned and put into shape by careful observers like the author of this book. In going through the volume it strikes one that the author gives his readers credit for knowing more about Japan and the language than most of them are entitled to, at least in this country. For instance, without a map, it is not likely that the general reader can follow the route taken by Mr. Dickson, nor be enlightened by the names of the towns or villages being carefully enumerated. Some of the frequently recurring Japanese words would be more intelligible were the English equivalent placed alongside. But it is just possible that the author wrote more for the foreigner in Japan than for the European reader.

Mr. Dickson made a number of excursions to different parts of the country. He describes the roads, mode of travelling, inns, natural features, and objects of interest, with all the accuracy of a guide-book, but without the dryness and ponderosity of that useful volume. There are many fine old monasteries and temples, stately castles of the old Daimios situated amidst beautiful scenery, in these "untrodden paths" of Japan, which can only be seen by travellers who, like Mr. Dickson, are fond of a tramp, and do not mind roughing it. Whether describing a waterfall, a bronze, a volcano, or a native fly-hook, the author does it thoroughly and evidently *con amore*. In the description of an old battlefield or a ruined castle we have the narrative embellished with some tale or legend illustrative of the scene or actors. There is some interesting matter about fishing, about deer and other wild animals, which will interest the naturalist, and much useful information about forests and forest trees, as well as some charming pictures of Japanese gardens, with their quaint buildings and tortured shrubs. We have also some details about Japanese domestic life which we do not remember to have met with in previous books. Altogether it is a delightful book, and written with a vigour of style and freshness of colouring which fascinates the reader, and makes him unwilling to lay it down. We can highly recommend Mr. Dickson's book to every one wishing to receive in a pleasant form much useful and interesting information about the Land of the Rising Sun.

Im Herzen der Haussa-Länder. Von Paul Staudinger. Berlin: Verlag von Adolf Landsberger, 1889. Pp. 758, and Map.

The flow of literature having Africa for a text increases in volume as it rolls on, and Mr. Staudinger's portly book forms one of the latest additions to our knowledge of Central Africa. It contains the account of a journey in the Western Sudan, together with a report on the German Niger-Benué expedition, as well as chapters on the climatology, ethnology, and natural history of the Haussa country. The author was the bearer of despatches and presents from the late German Emperor, William I., to the Sultans of Socoto and Gandu, having taken the place of the original leader of the expedition, the late R. E. Flegel.

The book is divided into two parts—the first, consisting of 491 pages, gives details of the journey, and is well written, and although it deals more or less with

the ordinary ups and downs of African travel, it has yet an air of freshness about it which is often wanting in the descriptions of modern journeys. The author is evidently a thoughtful man, and many of his passing observations are instructive and to the point; but we think that the second part of the book is the more valuable, as it records the scientific results of the expedition, and gives evidence of considerable capacity for detailed study. Not only is this seen in the geographical and climatological descriptions of the country, but more especially in the anthropological notes, which are carefully recorded, and do the author great credit. In fact, this portion of the book may be considered as a monograph, and it is well worth the careful attention of all anthropologists. It would be well if travellers would, as a rule, follow Mr. Staudinger's example and mass together their scientific facts, instead of mixing them up, as is usually the case, with the petty inconveniences of travel, the difficulties of dealing with natives, and the everlasting recurrence of attacks of fever. The map has been carefully compiled, and is very clearly drawn, and the only fault we have to find with the book is that it contains no index, but this is probably explained by the fact that the author was unable to see his work through the press.

Aalesund to Tetuan: A Journey. By CHARLES R. CORNING. Pp. vii+484. Paisley and London: Alexander Gardner, 1889. *Price* 6*s.*

The names which form the title of this book do not by any means indicate the extent of country visited during a sojourn of two years' duration, as the author's travels included the Channel Islands, North and South France, Monte Carlo, Italy, Norway and Sweden, Russia, Germany, Spain, and Morocco.

Mr. Corning is an American, and with that knowledge the reader may be prepared to meet with expressions of opinion tinged with the unpleasant sarcasm and brusqueness too common amongst our Transatlantic visitors. In this, however, he will be agreeably surprised, as we have seldom perused a narrative of travel in which the art of word-painting is used to such advantage. The author is no mere "globe-trotter," anxious to "do" the various show-places on his route; he has plenty of leisure at his disposal, and he turns it to good account by a careful study of the past history, the present position, and the future prospects of each town and village he visits.

Although, as previously indicated, Mr. Corning's statements are generally free from Yankee boastfulness, exception will be taken to that on p. 129, where we are told, with reference to Norwegian hospitality, "No people are so welcome as Americans. The Germans are hated, and the English sneered at, but we have no trouble." If this be so, there are hotel-keepers nearer home whose opinions do not coincide with it.

Chapters xi. to xvi. are almost entirely devoted to Russia, and are well worth reading. The author's experiences as to passports were very similar to our own; he writes (pp. 169, 170), "In my subsequent journeyings through Russia, my passport became so thickly covered with police permits and official stamps as to necessitate adding a small supplement to the sheet in order to get everything on, and even then they found the document not always adequate to official requirement. For the time being I became a living part of Russian history, but I paid liberally for my briefly assumed citizenship." The Russian drosky is rightly described as "popularly designed for the conveyance of passengers, but partaking somewhat of an instrument of torture." Commenting upon the motley array of people to be met with on the Nevski Prospekt

of St. Petersburg, Mr. Corning sententiously remarks, "With the exception of Naples, the capital of the Czar pours forth the worst-dressed population in civilised Europe."

A graphic account is given of the rejoicings at Madrid on the occasion of the marriage of King Alfonso XII., and as this event took place in November 1879, Mr. Corning's journey must have been undertaken some ten years ago, although his book is only now issued. The chapters devoted to Italy and the Riviera are full of picturesque details too numerous to mention, and indeed the whole book evidences the author's eminent capabilities for imparting to others the results of his own personal experiences. The Index, to be useful, ought to have been properly alphabetised.

Black's Guide to Paris and the Exhibition of 1889. By GASTON MEISSAS. Edinburgh: Adam and Charles Black, 1889. Pp. 110. *Price* 1*s.*

An excellent, handy, and complete guide, accompanied by a useful vocabulary. The information regarding Paris is brought well down to date, and the recently-erected monument to Gambetta forms one of the numerous pretty illustrations. There are several good maps, in one of which the words "English Diary" and "Goudaloupe" are evident errors. M. Meissas makes the questionable statement that "on the French railways generally the general comfort of the traveller when in the carriage is better attended to than in England." If the traveller goes, as he probably will, to and from Paris *via* the Chemin de Fer du Nord (Calais and Amiens) and finds, as he almost certainly will, every compartment full, or if he takes any of the other French express trains, all crowded, he will doubt M. Meissas as an authority on the comfort of French railways.

Rides and Studies in the Canary Islands. By CHARLES EDWARDES. Illustrated. Pp. xx. and 365. London: T. Fisher Unwin, 1888. *Price* 10*s.* 6*d.*

The Canary Islands are every year becoming more popular, as the steamship companies of the Australasian and African lines are giving increased facilities to tourists for visiting them. In addition to this, there is abundant medical evidence of their superiority to Madeira as a health resort.

Mr. Edwardes' book will be valued not merely on account of his having been enabled to penetrate into many corners of the islands considered inaccessible by ordinary tourists, but especially for the very interesting researches he has made into their early history. The curious customs of the Guanches, their religious observances and mode of life, are described at some length. Of the present inhabitants, Mr. Edwardes has much to say. He writes pleasingly, and with some knowledge of his subject, of his experiences and travels, which were chiefly confined to Tenerife. He has nowhere been unobservant, whether at church or market, or on the summit of the far-famed *Pico de Teide*, better known as the Peak of Tenerife.

The geology and fauna of the islands receive more than passing mention, and an appendix is devoted to supplying particulars as to communications, accommodation, roads, guides, language, etc., which cannot fail to be of service. There are numerous illustrations, and three small sketch-maps.

Thomas J. Comber, Missionary Pioneer to the Congo. By JOHN BROWN MYERS. Pp. viii. and 160. Portrait and Illustrations. London: S. W. Partridge and Co., 1888. *Price* 1*s.* 6*d.*

The Baptist Missionary Society has done splendid work amongst the natives on the Congo, and the name of Thomas J. Comber will long be remembered as

one of the ablest of its pioneers. His death at the early age of thirty-four came as a serious blow to the missionary cause; but his example of earnest, persevering work will, doubtless, act as an incentive to his colleagues who are left to carry on what he had so much at heart. Mr. Comber's exploratory journeys were begun during his residence in the Cameroons District, where (in April 1877) he made an ascent of the Cameroons Peak. Subsequently, in the Congo region, in company with Mr. Grenfell, he proceeded as far as Tungwa, the capital of Makuta. Some accounts of his journeys, together with maps of the regions traversed, have appeared from time to time in the *Proceedings of the Royal Geographical Society.*

Scenes in Hawaii; or, Life in the Sandwich Islands. By M. Forsyth Grant. Pp. xv. and 203. Toronto: Hart and Co., 1888.

The Hawaiian kingdom, owing to its geographical position, has become a port of call for the mail steamers crossing the Pacific, and opportunities for visiting it are thus taken advantage of by travellers from all parts of the world. Mrs. Forsyth Grant's experiences, however, were not limited to a brief inspection of Honolulu and its vicinity; her story is the outcome of a lengthened stay at a sugar plantation on one of the smaller islands of the Sandwich group. Chancing to sail from San Francisco by the steamer which conveyed King Kalakaua, Mrs. Grant was a witness of his loyal reception at Honolulu, and gives an account of the festivities organised to celebrate the return of the "King of the Cannibal Islands." Subsequently, His Majesty held a festival in honour of his coronation, although he had already reigned for nearly twelve years. Her residence amongst the islanders gave the authoress many opportunities of observing the characteristics of the country, as well as the native customs, dress, and appearance. The whole narrative would be both more enjoyable and more serviceable, were it not for the peculiar style of composition, at times so ungrammatical as almost to obscure the sense. The book is so excellently printed, and tastefully got up, that it is disappointing to find such an abundance of errors, typographical and orthographical. Several words appear with more than one variation in spelling, and in the middle of a very confused paragraph (p. 156), a royal monument is called a "statute," whilst, two pages further on, a quotation is written "To the *manor* born." Mrs. Grant has, in her preface, bespoken leniency on the part of critics, but, should her little book see a second edition, a more careful revision of the proof-sheets would add to its value.

Glimpses of Feverland; or, a Cruise in West African Waters. By Archer P. Crouch. London: Sampson Low and Co., 1889. Pp. 323. *Price* 6*s.*

However unattractive its title, this is a very interesting book. The author went to the west coast of Africa in connection with the laying of a cable to put certain places, principally French and Portuguese, in telegraphic communication with Europe. He describes how he voyaged from Accra to Lagos, Bonny, Old Calabar, Fernando Po, the Cameroons, St. Thomé, and St. Paul de Loanda. This is what he calls "Feverland," and yet at Bonny he found a Scotsman who had been seventeen years resident there, and was quite happy. "Here was a man," he says, "reduced by years of sojourn in this deadly region to mere skin and bone, his eyes burning with feverish brightness above his hollow cheeks, and his voice so weak and low as to be almost inaudible, actually delighting in

a life of chronic sickness and disease, and hugging the chains which had worn such deep scars into his frame."

Mr. Crouch traverses the opinion expressed in Stanley's *Through the Dark Continent* that the Negro is "equal to any other race or colour on the face of the globe in all the attributes of manhood." He says that all observers except Stanley bear testimony to "the low standard of the moral and intellectual capacities" of the Negro. He cites various authorities to prove the Negro's low mental capacity, want of feeling, absence of love, and low type of race. He maintains that the English missions cannot expect to make many zealous converts. "The only part of their teaching which is welcome to the Negro is the doctrine that all men are alike, and that a black man is as good as a white man." At the same time, he found, at Old Calabar, Negroes engaged in fitting together the huge palm-oil casks, and they proved to be useful and intelligent workmen, owing to the excellent industrial training afforded them at the German mission at Accra. This mission is called the Basle and Bremen Mission, and its system is radically different from the English, French, or Portuguese missions. Whilst the latter try to instruct the natives in the doctrinal instead of the practical side of our religion, the Germans "gain the goodwill of the natives by teaching them useful handicrafts, such as carpentering, coopering, etc., and with this instruction they mingle as much religious teaching as the native mind is capable of grasping. The plan has been very successful. They turn out trustworthy workmen, who are in great demand in all the factories down the coast." It is evident, therefore, on Mr. Crouch's own showing, that, given proper instruction, the Negro may be converted into a useful and intelligent workman.

The West Indies. By C. Washington Eves, F.R.G.S. London: Sampson Low, Marston, Searle and Rivington (Limited), 1889. Pp. xxiv+322. *Price* 7*s.* 6*d.*

Our West Indian possessions receive much less attention than they deserve, and present the one spot upon the globe where our administration shows a marked and by no means favourable contrast to that of other nations not, as a rule, very successful in colonial experiments. The reasons of this state of matters are many, and any inquiry regarding them would occupy too much space even to enumerate; but there can be no doubt that the two great factors that have brought about the present state of matters, were the abolition of slavery and the fall in the price of sugar. The result of the latter of these causes was partly the fault of the planters themselves, and they have had to learn the lesson, so often enforced but so seldom laid to heart in colonial experiences, that dependence on a single staple is, in the end, the sure road to ruin.

Mr. Eves has compiled a capital book, teeming with information such as is likely to prove interesting and useful to intending travellers in the islands; nor does he neglect the more solid, if less attractive, addition of copious statistical statement. He sees clearly the present position of affairs in the West Indies, and formulates it, but wisely refrains from preaching, or giving any prominence to his ideas as to the way in which a better state of matters may be brought about. That way must be found by responsible statesmen, and to them the task is left.

The illustrations are numerous and by no means badly executed; but the object of their presence seems principally to be to impress the fact that the Negroes are accustomed to carry their burdens upon their heads. Picture upon picture after this style is apt to pall. We wonder if it is a feeling of supposed

loyalty that causes Mr. Eves reverently to mark the spot where Prince Albert Victor and Prince George, during the cruise of the *Bacchante*, assumed jackets befitting the climate of the tropics, and makes him remark that certain commonplace buildings must have been observed by royal eyes.

The maps are good so far as they go, but books such as this ought always to be accompanied by a physical chart. There is no index. The volume, which is well "got up," is published under the auspices of the Royal Colonial Institute.

London: Illustrated by Twenty Bird's-Eye Views of the Principal Streets, also by a Map showing its chief Suburbs and Environs, and by a Street-Map of Central London. By the late HERBERT FRY. Pp. xviii+268. London: W. H. Allen and Co., 1889. *Price* 2*s.*

To supply within a small compass sufficient information to form a really serviceable guide to the vast world of London, requires not merely a very thorough knowledge of its intricacies, but a careful discrimination in its use. That this ninth issue of the late Mr. Fry's handbook proves his fitness for the task most readers will allow. His preface indicates the lines upon which he has carried out the work, and the dry facts are placed before us in so attractive a form as hardly to weary the most fastidious student.

It is somewhat startling to be told (p. 2), "Every sixth man in this realm is a Londoner." This conclusion is arrived at by taking the census return of the Registrar-General as to the population of London (that is "Greater London"), and comparing it with the total for England and Wales.

The pleasant task of accompanying Mr. Fry in his walks and drives in and about the great metropolis is greatly lightened by the numerous bird's-eye views, which are useful in helping us to identify the position of leading thoroughfares and landmarks. Few places of any note are dismissed without at least a passing word or two, and the many historical associations of London are treated with a fulness one could hardly have expected in so small a work. Mr. Fry is equally at home whether he is discoursing upon the history of the British Museum (p. 140 *et seq.*), or on the subject of tavern sign-boards (p. 70 *et seq.*).

The suburbs are also allotted a fair share of notice, and sections are devoted to postal information, railways, omnibuses, etc.; there are two good maps, and the whole is rendered useful for reference by a copious index.

London of To-Day: An Illustrated Handbook for the Season 1889. Pp. 388. *Price* 3*s.* 6*d.*

Brighton of To-Day: An Illustrated Book for all Seasons, but more particularly those of 1889. Pp. vi+127. Price 1*s.*

Folkestone of To-Day: An Illustrated Book for Visitors; Season 1889. Pp. 85. *Price* 1*s.*

By CHARLES EYRE PASCOE. London: Hamilton, Adams, and Co., 1889.

In the series of which these little volumes form a part, Mr. Pascoe endeavours to substitute for the ordinary Guide a considerable amount of information, told in a racy narrative style, both entertaining and amusing. It is doubtful, however, whether they will be of the same practical value in the hands of a stranger as if they had given more specific directions regarding the different localities in each town, or had been accompanied either by maps, plans, or index. The numerous illustrations are of the same amusing character as the letterpress.

Scotland in 1298: *Documents relating to the Campaign of King Edward the First in that Year, and especially to the Battle of Falkirk.* Edited by Henry Gough, of the Middle Temple, Barrister-at-Law. Paisley and London: Alexander Gardner, 1888. Pp. xlvi.+343.

We regret that the nature of the documents so diligently gathered, and so carefully and skilfully edited by Mr. Gough, makes any extended notice of this work unsuited for the pages of a purely geographical publication. Scattered through the volume unimportant data regarding various parts of the Lowlands will be found, but these are never of sufficient interest to call for particular remark. The antiquarian and genealogist, however, should reap a rich harvest from a careful perusal of the papers here transcribed, and to such the volume can be recommended with confidence. The care and attention bestowed upon his task by the editor are worthy of all praise, and it requires but a very superficial glance over the pages to recognise the many and great difficulties he must have met with, and which, in most instances, he has satisfactorily overcome. The extended index appended to the volume is a model of careful compilation, and will prove of great utility to any one consulting the documents for particular information.

The book is a very handsome production, well bound, and printed in clear type on excellent paper. The use of the old-fashioned "s" in the introduction and body of the work appears to us to smack somewhat of affectation; that seems the only fault to be found with this very excellent and interesting collection of important historical documents.

The Useful Native Plants of Australia (including Tasmania). By J. H. Maiden, F.L.S., F.C.S. London: Trübner and Co., 1889. Pp. xii+696.

The author has compiled a very complete catalogue of the useful plants of Australia, accurate in detail, and clear in plan. The plants are divided into classes:—human food and food products; forage plants; substances reputed medicinal; gums, resins, and kinos; oils; perfumes; dyes; tans; timbers; fibres; miscellaneous. Under each of these headings the plants are arranged alphabetically according to their botanical names, followed by generally minute and clear descriptions of each, with its uses and habitat. References are also given which are likely to prove useful to those undertaking a closer investigation than Mr. Maiden's space has permitted him to indulge in. The work is a most painstaking one, with an index including not only the scientific name of each production described, but also the common and native names. Thus the annoyance of a protracted search is spared the reader. The type is bold and clear, and the volume is altogether pleasant to use, and certain to prove of great value as a work of reference.

In Other Lands. By Caroline Gearey. London: Digby & Long. Pp. 264. *Price* 3*s.* 6*d.*

A gossipy but amusing little book, in which a lady narrates her experiences in Spain, Italy, and Austria. Her criticisms are usually just, and she writes with feminine fluency, as when she refers to "beautiful, dirty, disgracefully dirty, but piquant and picturesque Naples." In Spain, however, she was compelled to forego visiting Seville and Granada on account of the prevalence of earthquakes. So, as she herself admits, her Spanish tour was "something like the play with Hamlet left out of it."

Yours truly
Fridtjof Nansen.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

JOURNEY ACROSS THE INLAND ICE OF GREENLAND FROM EAST TO WEST.

(Read at Meeting of Society, Edinburgh, 1st July, 1889.)

By Dr. Fridtjof Nansen.

(With a Map.)

Since Greenland was discovered about nine hundred years ago, the interior of that continent has remained a mystery to Europeans as well as to the Eskimos, and many are the opinions and suggestions which have been put forward as to its real nature.

Our forefathers, the old Vikings, who first discovered Greenland, maintained that it was only the land near the coasts which was not ice- and snow-clad, whilst the interior was covered with a sheet of ice so thick that only in some few places could you see the ground underneath. This is, indeed, a fairly correct view, and until quite recently nobody knew more of it than this.

Many attempts have been made to penetrate into this mysterious interior. I shall here briefly mention only a few of them.

The first expedition known of was one undertaken in the middle of last century by a Dane, Paars, who was a major in the Danish army, and the first and last Governor of Greenland. He was sent by the Danish Government, with an escort of about twenty soldiers, with wives and children, twelve horses, guns, etc., and was ordered to cross Greenland on horseback from the west coast, and when he reached the east coast to build a fortress, found a colony, and take care of the old Norsemen who were thought still to survive. I need not tell you that this expedition only reached the inland ice and returned filled with horror. Major Paars wrote a very vivid description of all the dreadful dangers

that would be encountered on an expedition on the inland ice of Greenland. The impossibility of crossing Greenland was at once settled. Notwithstanding this there have been a great many attempts since that time.

Another Scandinavian, Dalager, who also lived last century, was more fortunate, and really walked over the ice several miles. Several Norwegians and Danes have also made the attempt this century, but did not succeed. In 1867 two well-known Englishmen, the famous alpinist, Whymper, and Dr. Robert Brown, also tried to penetrate into the interior, but were unfortunate; they met with very difficult ice, and were obliged to return some few miles from the coast.

More fortunate were the following expeditions:—that of Baron Nordenskiöld in 1870; the Danes, Captain Jensen, Kornerup, and Groth, 1878; Nordenskiöld again in 1883; and the American Peary with the Dane Maigaard in 1886. These last reached about 100 miles from the coast, and a height of about 7500 feet.

All these attempts were made from the west coast, but from the little-known east coast nobody had tried, so far as is known.

How the plan of my expedition across Greenland was ripened in my youthful brain I shall not try to explain here. I got the idea one day in 1882, whilst on board a Norwegian sealing-ship we were ice-bound for twenty-four days near the still unknown part of the east coast of Greenland, and from that time I could not get it out of my mind.

My opinion was that if you fitted out an expedition in a proper way it was not at all an impossibility to cross Greenland, and the very men for such an expedition would be Norwegian "ski-runners." The Norwegian snow-shoes called "ski" are just the thing for traversing snow-fields, and that snow would be found in the interior of Greenland I never doubted. But there was another thing which also in my opinion was of the greatest importance, and that was the place from which to start. If we started from the west coast of Greenland I was quite sure we should not be able to cross, for then we should leave "the flesh-pots of Egypt" behind us, and in front of us would be the ice-desert and the east coast, which is not much better, and when we reached this coast we should have to cross to the west coast to be rescued. Even if one could keep up his own spirit to this, he might not be able to force his men forward when the food began to decrease.

I thought the only certain way was to penetrate the floe-ice and land on the desolate and ice-bound east coast between 65° and 66° N. latitude, and start from here for the inhabited west coast; in that way we would burn all bridges behind us, it would not be necessary to force the men forward, they would certainly have no temptation to return, whilst in front of us we would have the west coast inviting us with all the comforts of civilisation. They had no choice, only "forward." Our order was, Death or the west coast of Greenland. In this way was it accomplished.

When I first put forth my plan to cross Greenland most people said I was either mad or tired of my life. Neither was, however, the case; and, notwithstanding all warnings, more than forty men offered to accom-

pany me. I selected three Norwegians, viz. Captain Sverdrup, Lieut. Dietrichsen, and a peasant, Kristian Kristiansen Trana. From Lapland I got two Lapps, Samuel Balto and Ole Ravna, who, I hoped, would in various ways be of use to us, but I was rather disappointed; they were good and strong men, though Norwegians would have done just as well, and in dangerous positions they were easily frightened.

I must here acknowledge the liberality of Mr. Gamél, of Copenhagen, who contributed largely to the expenses of the expedition.

In the first days of May last year the expedition started from Christiania, and went *viâ* Scotland and the Faroe Islands to Iceland, where, on the 4th of June, we embarked on board the Norwegian sealing-ship *Jason* for the east coast of Greenland.

The coast of Greenland was not, however, as easily reached as expected, the floe-ice occurring in larger quantities than it generally does. For six weeks we had to wander about among the ice between Iceland and Greenland before we could approach the coast, so that I thought it convenient to leave the ship.

At last, on the 17th July, we left the ship in the ice near Cape Dan, outside the Sermilik fjord. A salute from the guns of the ship announced to the solemn and silent ice-world surrounding us that we were burning our last bridge leading back to civilisation and comfort. From this moment we had to take our own way. It was with strange feelings that we six men parted from our friends on board the ship and steered our two boats into this desolate ice-world, which now was going to be our home for a long time. We had, however, all of us the best hope of succeeding; that dangers and hardships were coming we knew, but we felt sure that we would overcome them.

The first thing we had to do, and a very important thing indeed, was to reach land. But before we could do this, we had to force our way through an ice-pack of about ten or twelve miles' breadth, and this was one of the most difficult parts of the whole journey. I had originally hoped to penetrate the ice in one or two days, but we met with a quite unexpected strong and dangerous current, which pressed the ice-floes against each other, and where we had to take great care that our boats should not be crushed; to make things more difficult we got for some time fog and heavy rain. In spite of all this we advanced, however, for about twenty hours rather rapidly, towards land. I could see the stones on the shore, and was already quite sure of reaching it within a short time, when we had the misfortune of getting one of our boats crushed during an ice-pressure; it could not float, and we were obliged to take it up on a floe to get it mended. This required several hours, and in the meantime we were swept southwards by the rapid current; the distance to land increased rapidly, and the speed with which we were swept along was so great that it was in vain to try to struggle against it. We had nothing left but to take leave of the beautiful mountains and the glaciers round the Sermilik fjord, and to look out for another landing-place, or perhaps destruction in the floe-ice, with its capricious currents, which at times carried us towards land, and at times again towards the open sea. To make the position still more awkward, we got heavy rain, which wet us

through to the skin. We could do nothing better than pitch our tent on the ice-floe and creep into our sleeping-bags to take a sleep, which, after twenty hours' constant hard work among the ice, was rather welcome.

I shall not tire you with a description of our drift along the east coast of Greenland: how we dragged our boats over the ice-floes, how we worked hard and tried to force our way towards land, how, in the nights, with those charming Arctic sunsets which call forth in your mind all your most tender feelings and dreams of your childhood, how we then could be seen throwing longing looks towards that wild and beautiful coast whither our only longing was, but from which we were parted only by some few miles of vexing ice.

I will not tire you with a description of how often we hoped to land, how often we were disappointed, and how often we were nearly wrecked amongst the ice; the worst of it was, that the precious summer-time was passing away, and we were not able to use it; the difficulty of carrying out our plans grew greater every day.

That you may get an idea of what risks one runs in such ice-currents, I shall here only tell you of a day and night we had there. It was one morning we observed that we were rapidly carried by a strong current towards the open sea, where a heavy sea was coming from the east down upon us; it was in vain to try to drag our boats over the floe-ice against this current; it was inevitable that we must come into the dangerous breakers at the margin of the ice, where it was impossible to stick to the ice. The ice-floes were smashed to pieces all around us; our own floe was broken into several pieces; we had nothing to do but select the strongest ice-floe we could find in the neighbourhood and to prepare for a struggle for life as hard as possible. We selected a strong floe, brought all our things and provisions into our two boats, which were standing on the ice-floe; only our tent and two sleeping-bags were still left for use on the ice. Towards night all was ready; we were then some thousand yards from the open sea; we could only too distinctly see how the ice-floes were washed by the heavy breakers, so that everything was swept away, how they were broken to pieces and then almost crushed into powder; within a few hours we would be at the outside margin, there would be nothing left but to try to get our boats through the breakers and enter the open sea; but, as it was best to face this struggle with as fresh energies as possible,—all men were ordered to sleep except one, who should keep watch and call us when it would no longer be possible for us to maintain our position. While Captain Sverdrup took the first turn, we crept into our sleeping-bags, and, as we were tired—all of us—we fell fast asleep within a few minutes. Even the Lapps slept well, though they had been dreadfully anxious all the day, and were quite sure they had seen the sun setting for the last time; one of them, who did not find the tent safe enough, slept in one of our boats, and did not even wake when the breakers very nearly had swept the boat away, so that Sverdrup was obliged to hold it.

After some time I was awakened by hearing the breakers roar just outside the tent; I expected to hear Sverdrup call, or to see the tent swept away, but Sverdrup did not call and the tent stood; I heard the

thunder of the breakers for some time, but then I did not remember anything more. I fell asleep, and did not wake again until next morning, when I was astonished to discover that we had again approached land, and were far distant from the open sea.

Sverdrup then told me that our position had been rather awkward for some hours in the night; we had had a large mass of ice by our side, which threatened to crush our floe every moment, and the breakers swept over our floe on all sides—only the spot where the tent was standing was spared. Once he came to the tent-door to call us. He unfastened one hook, but then thought he would yet look at the next breaker coming: this was worse than the former one. He returned to the tent, unfastened one hook more, but thought it best to wait and watch what the next breaker would be like. He did not unfasten any more hooks. Just at the critical moment the current turned, and we were again carried towards land, away from the dangerous breakers.

On the 29th of July we landed at Anoritok, which is, however, not very far from the south point of Greenland, and is situated in 61½° N. lat., consequently about 250 miles south of the place where we intended to begin our journey across the continent. It was then very late in the season: the best time of the short Greenland summer had passed away, and there was but little left. It would have been very easy to reach the Danish settlements on the west coast near Cape Farewell; northwards the floe-ice was pressed tightly against the coast all the way. We had to choose here between certain rescue in the south and the accomplishment of our plans, or perhaps death in the north. If I had asked my two Lapps I was sure of the answer—it would have been southwards on any conditions; but if I had asked my brave Norwegians I was just as sure that the answer would be northwards—we should not at any risk give up our plans. None of them were, however, asked. Arrived inside the ice, the boats were steered northwards without any order: there were no thoughts of giving up our plans yet, there still was left time enough to cross Greenland if we used our time well. I will never forget the sensations which possessed us when we passed the last floe that parted us from land; it was as if we had escaped a long and dreary prison and saw life lying bright and gay before us.

And certainly life was bright, but I will not say we had much comfort, or rather much time to enjoy it; the order of the day was to sleep as little as possible, eat as little and as quickly as possible, and to work as much as possible. Our food was water, biscuits, and dried meat; for cooking we had no time, though there was game enough. The ice was very difficult, we often had to break our way through it by help of axe and poles. It often looked almost hopeless; it would take us hours to advance some few feet, but we advanced, and that is always better than to go backwards, and I had five brave companions who would not give it up. On the way we met with several encampments of heathen Eskimos living on this desolate coast. We hoped to get some help from them, but they could not advance through the ice so well with their skin boats as we could with our wooden ones, and we were obliged to leave them.

At last, on the 10th of August, we reached a place called Umivik, where I thought it convenient to begin our ice journey. After having examined the glaciers in the neighbourhood and found a good way, and after having made everything ready, we left our two boats on the coast and started on our journey across the unknown interior of Greenland. Our destination was the Danish settlement of Kristianshaab, at Disko Bay.

We had five sledges; the load on four of them was about 200 lbs. each, and on the fifth about double as much. The last was pulled by Captain Sverdrup and myself, who took the lead, the other four members of the expedition following, each pulling one sledge. Our food consisted principally of dried beef, pemmican, meat-biscuits, dried bread, butter, *pâté de foie gras* (not the Strasburg luxury), meat-chocolate, common chocolate, tea, etc. Besides provisions, we had on our sledges scientific instruments, guns, Norwegian snowshoes (called *ski*), Canadian snowshoes, Alpine axes and walking-sticks, Alpine ropes, one tent for all six, and two sleeping-bags of reindeer skin. As we slept three men in each bag, they were very warm; and we could stand the very low temperatures we had in sleeping on the snow.

Notwithstanding the very steep slopes we had to climb, and the many crevasses, etc., we advanced rather rapidly for two days; then we were stopped by a storm from the north, with heavy rain, and we had to stay in our tent lying down in our sleeping-bags for three days, while the ice melted rapidly under us, and the rain poured down above.

At first the snow was very uneven, but hard and good for sledge-pulling. There were plenty of dangerous crevasses, so that we had to be vigilant: no accidents happened, however. Occasionally some one fell up to the arms through the snow-bridges by which we had to pass over the large crevasses, but by help of the Alpine axes a deeper fall was prevented.

At some distance from the coast, however, the snow became very soft, and bad for pulling, and our difficulties went on increasing: the snow became looser, and the pulling was very hard work, even if we had not had a continuous snowstorm beating against us. I hoped that it would soon become better, but each day it became worse. It was only too clear that if it continued in this way we would not be able to reach Disko Bay till the middle of September, when the last ship left for Europe. We should thus have no hope of returning home the same year (1888) if we continued our way to Kristianshaab. We should probably have more hope of reaching a ship at Godthaab, situated further to the south, on the west coast of Greenland; and as I thought this direction to be of more scientific interest, I changed our route and turned towards Godthaab, though I expected to find more troublesome ice in this direction, and though it would be much more difficult to reach the Danish settlements for rescue after leaving the inland ice. That was on the 27th of August. We had then reached about 64° 50′ N., about 40 miles from the coast, and a height of about 7000 feet. By this change of direction the wind became so favourable that we could use sails on the sledges, and thus they became less heavy to pull. In this manner we advanced during three days; then the wind went down, and we were obliged to lower our sails.

In the beginning of September we reached a quite flat and extensive plateau, which resembled a frozen ocean. Its height was between 8000 and 9000 feet, though towards the north it seemed to be considerably higher. Over this plateau or high land we travelled more than two weeks. The cold was considerable. I am not, however, able to give an exact statement of the temperature, as our thermometers did not go low enough. I believe that on some nights it was between $-45°$ and $-50°$ Centigrade (between 80° and 90° below freezing-point, Fahrenheit). In the tent where we (six men) slept, and where we cooked our tea and chocolate, it was even less than $-40°$ Centigrade (72° of frost, Fahrenheit). During one month we found no water. To get drinking water we were obliged to melt snow either in our cooking apparatus or by our own warmth in iron bottles, which were carried inside our clothes on our bosoms. The sunshine on these white snow-fields was bad for the eyes, but no case of snow-blindness occurred.

To give a description of the scenery during the day in this region is easy. We saw only three things: that was snow, sun, and ourselves. One day was quite like another. But still, even this part of the earth has its beauties, and I shall never forget the glorious sunsets and the nights on the snow- and ice-fields of Greenland, when the ever-changing northern lights were scintillating perhaps brighter than anywhere else. I shall never forget the strange impressions, as from another world, we derived in this solemn, silent nature, as we saw the lights spreading like a terrible fire over the whole sky, then gathering again in the zenith, as if swept together by a storm, always flitting, burning, and scintillating, and then at once disappearing, leaving the monotonous snow-fields in darkness as they were before.

Another more soothing and peaceful impression came upon us when the moon appeared and made its silvery way over the limitless snow-fields, over which the stars were sparkling with a brightness unknown in other latitudes. Indeed, I am certain that none of us will ever forget our night wanderings over the snow-fields of Greenland.

The landscape was not always, however, so peaceful as here described, sometimes we met snow-storms, and you often saw nothing but drifting snow. One day, the 8th of September, we were even obliged to remain in our tent, whilst it was nearly torn to pieces by the storm; the next day, when we wanted to continue our journey, we found that the tent was almost quite buried in the snow. We had to dig ourselves out through the snow, and we had to hunt for our sledges, which had quite disappeared; that, however, was very often the case in the mornings.

As to our daily life in these inhospitable surroundings, with a temperature of 70° to 90° of frost, Fahr., I shall not tire you with a particular description of that. I shall only say that we stood it pretty well.

The worst thing was to turn out in the morning. It sometimes happened that I found my head in the sleeping-bag surrounded by a crust of ice and rime caused by the freezing of my breath. To turn out an hour before the others to cook, and be obliged to touch iron articles and get spirits of wine on your fingers, was not very agreeable. I had

this pleasant work every morning, as the others, when they tried it, generally used too much fuel, and we had to be careful in that respect, as we could not get any water without fuel.

As to cleanliness, we could not afford to indulge much in that luxury. I am afraid you will consider me a thorough barbarian when I tell you that we did not wash ourselves from the time we left the ship *Jason* until we reached the west coast, that is, during two months and a half, and during that time we were never out of our clothes. That we did not wash had, however, its peculiar reasons: on the one hand we had no water; but, on the other hand, even when we had it, washing was strictly forbidden, as the washing of the face is very injurious on snow-fields, where the sun is constantly shining; the skin is easily blistered, and the sun can cause you dreadful pains.

Our cooking was not always of the tidiest character; we had no water to wash our cooking vessel, and when we had cooked pea-soup in the night, we had to cook tea or chocolate in the same vessel next morning, with the remains of the pea-soup in it. It was, however, rather good, as we could not afford to throw away anything in the nature of food, neither were we very particular about what we got to eat. I remember one night our cooking apparatus was upset, and all our precious pea-soup was poured out over the canvas floor of our tent; but we did not hesitate: we immediately took hold of each side of the floor, lifted it up, and sucked the pea-soup out of the middle. No drop was lost. We were compelled, in fact, to live like natives. Mashers, I fear, would not succeed in the interior of Greenland.

On the 19th September we got a favourable sailing wind, so that we could use sails on our sledges. We had only to stand on our *ski* and hold on to our sledges, while we rattled down the slope towards the west coast, sometimes with a speed quite astonishing. Certainly that was the most delightful ski race I ever had in my life.

Towards night, when it was getting dark, and as we were travelling at a good speed, I observed a dark spot in front of us. I did not understand what it was, but went straight ahead. At a distance of some few steps further, however, I discovered that it was a broad crevasse; the sledges were immediately turned just at the right moment; we were already on the margin of the crevasse; a second longer and the three of us leading with two sledges would have disappeared, and nothing would have been heard of us any more.

We had to be more vigilant after this. When the night came, we would use the favourable wind as long as possible, and as we got moonlight, we could sail on for a very long time. I went in front examining the ice, and the sledges came sailing afterwards. We had to pass many crevasses, but no accidents happened. Once, however, a snow-bridge over a very deep and broad crevasse fell down just when we had passed over, and very nearly took with it two men and two sledges. In the middle of the night we were at last stopped by ice so filled with crevasses that we could not advance any longer, and we had to pitch our tent and go to sleep. We were now very near the coast, but met with ice so difficult and uneven, and filled in all directions

with immense crevasses, that we could advance only very slowly. At last, on the 24th of September, we reached land at a small lake to the south of Kangersunek, a fjord where a large glacier issues.

On the 26th September we reached the sea at the inner end of the Ameralik fjord, in 64° 12′ N. lat. I shall never forget what pleasure and enjoyment it was to get water again, so that we could drink as we liked—no wine could have tasted better; and what a comfort it was to have any quantity of fuel, willow, and heather, so that we could make an open fire in the night and cook as much as we liked!

We had now reached our destination—the west coast of Greenland. The distance we had passed over the inland ice was about 260 miles. The interior of Greenland was explored, at all events in one direction, in spite of the general opinion that it was impossible to penetrate it. We had now only one thing left, and that was to get into communication with other human beings. This it was desirable to do as soon as possible, as we had not very much food left; we had plenty of dried beef, but we suffered from want of fat. But Godthaab, the nearest place where people lived, was still a distance of 50 miles away. As I saw that it would be no easy task to reach this place by land, the mountains being too difficult to pass, I thought it better to go by sea, and determined to make a boat. The next day three of us made a boat out of the canvas which formed the tent floor, of the bamboo rods used on the sledges, and willow boughs found near the shore. Towards night our boat was ready.

Next day, September 28th, Captain Sverdrup and I started with this boat for Godthaab. The first portion of the way we had to carry it, as the fjord is filled with glacier mud. This was rather a heavy task, as we often sank into the mud up to our knees. Next day we reached open water and got out of the Ameralik fjord. For some days we got contrary winds, and the boat was very heavy to pull against wind and sea, it being too broad as well as short. On the 3d of October we reached Godthaab, and were heartily welcomed by the population. Two boats were sent to bring the other four members of the expedition to Godthaab. Being stopped by a heavy storm, these boats were, however, obliged to wait for several days. At last, on the 12th of October, they arrived, and all of us were assembled in Godthaab. The expedition was finished, and Greenland was crossed for the first time.

My hope to find in Godthaab a ship for Europe was disappointed. I, however, learned that at Ivigtut, about 240 miles south of Godthaab, there was still a ship, the *Fox*, which in the middle of October was to leave for Denmark. I sent immediately a messenger (an Eskimo in his small skin-boat or kajak) to the *Fox* to ask the captain to come and take us home. As the season was very late, and as the captain of the *Fox* did not know how much ice there was towards Godthaab, he dared not come, and we were obliged to spend the winter in Greenland. Strange to say, this ship, the *Fox*, which brought the message to Europe that we were safely arrived at the west coast of Greenland, is the same ship which Sir Leopold M'Clintock commanded on his famous expedition in search of Franklin.

To spend a winter in Greenland was not very disagreeable to us. We had a pleasant time of it: there was plenty of shooting, sea-birds, ptarmigan, and reindeer; there was snow enough to enable us to use our *skis*. But the most fascinating of all was the life in the kajak—this small Eskimo skin-boat, only capable of holding one man, which certainly has not its equal, and is the best one-man vessel in the world. It is propelled by a paddle, and when you have learnt to manage it properly, you may go against the heaviest storm. If you are capsized by a sea, and can manage your oar, you can rise again and need not be afraid of anything. A skilled Eskimo can, in his kajak, go even 80 miles in one day.

For one who cannot manage his kajak easily it is rather a dangerous sport, and many Eskimos perish in the kajak every year; in Godthaab and neighbourhood six were thus drowned this winter,—but that is one of the reasons, perhaps, why kajak-sailing is so fascinating.

On the 15th of April this year the Danish steamship *Hvidbjörnen* came to bring us home, and we left Greenland, almost sorry to part from its happy people,—those children of nature, who have no experience of the miseries of civilisation, and who do not know real poverty. Sometimes they are in want, but generally they have plenty of food, and are always happy and content.

The voyage homewards was as pleasant as possible.

The scientific results of the expedition cannot at present be stated, the many observations not having been worked out by the specialists to whom they have been submitted. There are, however, some points which, especially in geological and meteorological respects, even at present are prominent; and though I am no geologist and no meteorologist, I shall mention some of those which to my mind are of much interest.

And first, I think the shape of the inland ice is of importance.

Many geologists have suggested that the interior of Greenland was ice- and snow-clad, but there have been others who were of the opinion that it was not snow-clad. Amongst the latter I will here especially mention the famous Nordenskiöld.

This prominent explorer of Arctic regions, who has seen more of ice- and snow-fields than most people, held the opinion that we are not entitled to conclude that the ice-covering extends throughout Greenland from coast to coast, notwithstanding that nobody had seen the boundaries of the "ice-desert." He even believed "that it in most cases is a physical impossibility, that the interior of a large continent should be completely covered with ice under the climatic circumstances which occur on our planet south of 80° latitude." As to the interior of Greenland, he says that it is even easy to prove that the conditions for the forming of glaciers cannot occur there if the surface of the land does not gradually and regularly rise from the east coast as well as from the west coast towards the centre. But, in Nordenskiöld's opinion, no continent, the orography of which is known, has such a shape. Greenland he supposes to have an orographical embossment very much like Scandinavia; that is, it consists of mountain ranges and peaks separated by deep valleys and plains. As, in such a country, most of the rain and snow must fall in the neighbourhood of the coasts, whilst the interior is reached only

by dry and warm winds, there cannot be moisture enough to form a glacier there.

I will not here criticise Nordenskiöld's theories. The expedition from which I have just returned has, in my opinion, fully proved that they cannot be right as far as concerns Greenland. It is, I hope, proved that Greenland is not only ice- and snow-clad, but has a mighty shield-shaped covering of snow and ice, under which mountains as well as valleys have quite disappeared, and where you cannot even trace the configuration of the land and mountains. Whether this is also the case in the most northern parts of Greenland I dare not yet say; this must be decided by a new expedition, which would be of the highest interest.

At present we will only consider the southern parts of Greenland. The ice-covering has here, as already mentioned, the shape of a shield. Rather rapidly, but regularly, it rises from the east coast; reaches a height of 9000 to 10,000 feet; is rather flat and smooth in the middle; and falls again regularly towards the west coast. Considering this peculiar and uniform shape of the ice, the first questions that must force themselves upon us are, What has occasioned this uniform shape? what is the configuration of the land underneath?

I have heard geologists say that, judging from what has been observed by us, it is clear that Greenland is a tableland, the exterior parts of which are only excavated by the glaciers, so that fjords and valleys are formed, whilst the interior evidently has the shape of a high plateau, where no considerable valleys or mountains can be present, there being no glaciers to excavate the ground.

I think this conclusion is entirely false. I think that the shape of the surface of the inland ice is not at all caused by the configuration of the land underneath.

Nordenskiöld is certainly right when he says that the configuration of Greenland is very like that of Scandinavia, and especially that of Norway, and let us also say that of Scotland.

In the interior of Greenland, as well as near the coast, there must be mountains and valleys, just as well as here. That on the coasts there are formed deep fjords and lofty mountains very like those of western Norway we already know; they have just the same wild and prominent character in some places; they are perhaps even wilder than those I have seen in my own country.

If we entertain the opinion that these fjords are excavated by the ice, we must also conclude that the same ice has been able to excavate valleys and form mountains in the interior of the continent; to this subject I shall, however, return a little later. At present I will only state, that we have no right to attribute the reason of the shield-like shape of the ice to the configuration of the land underneath; the surface of the ice must have a shape of its own, which is given not by the land but by the meteorological conditions. Nobody can deny that the ice must in some places have quite an enormous thickness, as it fills the valleys and covers up all the mountains, and its thickness must evidently be regulated by the quantity of snow falling. This quantity must be largest

towards the coasts, gradually diminishing towards the interior. It is consequently very likely that the ice has not its greatest thickness just in the middle of the continent, but rather on both sides towards the coasts. We might thus already, *à priori*, have expected to find the shape of the ice just like that observed.

I have already mentioned that the surface of the snow-field in the interior is quite even and, as it were, polished. It has a striking resemblance to the undisturbed surface of a frozen ocean, the long but not high billows of which rolling from east to west are not easily distinguishable to the eye.

The principal agent which makes this surface so remarkably even is the wind. The levelling influence of the wind may easily be studied in our own mountains in the winter; there it may be seen how its prevailing effect is to remove every prominence: the snow is carried from the mountains into the valleys; it fills them and makes the mountains disappear.

This has of course also been the case in Greenland, only to a much larger extent, when its present glacial period commenced. The snow increased annually; gradually the valleys were filled up, the mountains disappeared, and the snow-field was produced which we now see. The work of the wind now is to level and polish the surface of this vast field, and make it as smooth as the surface of a lake in quiet weather, where you find no spot to fix the eye upon or where you can let it rest, where you have to use your compass just like you do at sea.

The surface of the snow-field in the interior consists of soft, loose and dry snow, which is easily moved by the wind. Even in mid-summer there is no snow-melting of importance in the interior. Even with the six-feet-long sticks we use for *ski*-running, I could not reach hard ice or snow underneath the soft layer. At intervals of six to ten inches quite thin ice-crusts occurred; between them there was, however, soft snow like that of the surface. These thin ice-crusts are evidently formed by the direct influence of the sun during midsummer. The sun in the middle of the day is then able to make the surface of the snow to melt a little; in the night, however, it freezes again. Whether these ice-crusts at certain intervals indicated annual layers of snow, or whether they only indicated heavy snowfalls during the summer, I am not able to decide; I am, however, inclined to hold the latter opinion, at all events to some extent.

I previously mentioned that we had snowfalls almost every day. When we compare this with the fact just stated that there is no real snow melting in the interior, it would seem as if we were obliged to conclude that the quantity of snow is still increasing in the interior of Greenland. This cannot, however, easily be the case, at all events not in any considerable degree, for if it were so, the quantity of ice and snow must also increase towards the coasts.

Judging from the observations and measurements which, during several years, have been made on the west coast of Greenland, it seems, however, as if the ice varies a little from one year to another, but that upon the whole its quantity keeps very nearly on the same level. We are not

GREENLAND
Scoresbys Land
Davys Sound
Liverpool Coast
Scoresbys Sound
Blosseville Coast
C. Grivel
Kangerdlugsuak
C. Nord
Ice fjord
Dyrefjord
Kialineck
Ingolfs Fjeld
C. Dan
Angmagssalik
DENMARK
STRAIT
ICELAND
Reykjavik
Arctic Circle
King Christian IX Land
Inland Ice
King Frederick VI Coa.
Svartenhuks Halvo
Umanak Fjord
Umanak
Disko
Godhavn
Disko Bay
Egedesminde
Christianshaab
Lappernes Route 1870
Nordenskjolds Route 1883
Holstensborg
Sukkertoppen
Godthaab
Nunatakker
Nansens Route 1888
Ivigtut Fjord
Fiskernes
Frederikshaab
Ivigtut
Julianehaab
Namortalik
C. Farewell
Aluk
Ujarak
Akorninarmiut
Ikigait
Tasiusak
Andretok
Ririk
SKETCH-MAP
SHOWING
DR. NANSEN'S ROUTE
ACROSS GREENLAND.
August 1888.
Scale of English Miles
0 50 100 200
Long. 40° W of Greenwich
John Bartholomew & Co. Edin.

thus entitled to assume that the quantity of snow is increasing in the interior.

But what is the reason why it does not increase?

As already mentioned, the snow-melting cannot be of any importance. The evaporation from the snow-surface cannot, in my opinion, be of much more importance, as it must be quite a trifle with such a low temperature of the air, and where most days a little snow falls. A factor of more importance is, I think, the snow-drifts occasioned by the wind, which very likely has a disposition to blow from the cold and high interior towards the lower and warmer coasts. In the middle of the continent the winds blow, however, in all possible directions, and thus even this factor is of no great importance. The principal factor in maintaining the level must, in my opinion, be the pressure which is produced within this immense layer of ice and snow. This pressure forces the ice downwards along the sloping sides of the mountains, through the valleys and towards the sea, into which it falls in form of ice-streams or glaciers, and is carried away in form of icebergs or is melted.

To a great many people it does not seem necessary that the ice must force its way to the coast in this manner, but I think that if we said that the interior of Greenland was filled or covered by an immense layer of pitch, nobody would doubt that this would find its way to the sea; yet, there is really in that respect no great difference between these two materials; by the immense pressure the ice is probably made even more viscid than melted pitch. But the pressure brings the ice to the sea not only in the form of ice, but also, and certainly in larger quantities, in the form of water. As is generally known, ice has the peculiarity that by pressure it can be transformed into water. At a certain depth we must therefore expect to see the ice thus transformed.

ON MARINE DEPOSITS IN THE INDIAN, SOUTHERN, AND ANTARCTIC OCEANS.

(With a Map).

By John Murray, LL.D., Ph. D., etc.,
of the *Challenger* Expedition.

In an article published in this Journal for November 1887 I gave some account of our knowledge of the deeper regions of the Indian Ocean, with special reference to the investigations carried on by Captain J. P. Maclear in H.M.S. *Flying Fish* during 1887.

Since that time extensive additions to our knowledge of the bathymetry and physical conditions of this ocean have been made by Captain Pelham Aldrich in H.M.S. *Egeria*, and by Captain A. Carpenter in H.M.S. *Investigator*. Through Captain Wharton, the Hydrographer of the Admiralty, I have received details of these investigations, and also the most excellent and valuable series of deposits collected with care by Captain Aldrich. These samples of the marine deposits have been submitted

to a careful examination. In addition to those obtained by H.M.S. *Egeria*, I have recently examined a very large collection of deposits from the eastern coasts of Africa, made on board the ships belonging to the Telegraph Construction and Maintenance Company, while engaged in laying cables along that coast. Captain Carpenter of H.M.S. *Investigator* has also sent me numerous samples from the Bay of Bengal. These observations have filled up so many gaps in our knowledge of the deposits of these regions that, in the accompanying map, I have been tempted to indicate graphically their extent and distribution.

In the *Egeria* Captain Aldrich made a very extensive series of deep-sea soundings from Christmas Island to the Mauritius, then southward to nearly the 40th parallel of south latitude, and then eastward to the coast of Australia. It is a little remarkable that this splendid series of soundings has caused us to alter the contour lines of depth to only a small extent: the area over 3000 fathoms has been considerably increased, the 2000-fathom line has been shifted in some places, but, on the whole, there is little alteration to be made on the bathymetrical map which I published in 1887.[1] This circumstance gives us reason for believing that our knowledge of the contours of the great oceans is slowly approximating to the truth.

In order to give the reader some idea of the data from which the accompanying map has been constructed, a red mark has been placed at each position where there have been actual and reliable observations as to the depth and nature of the deposits in all depths of 1000 fathoms and deeper: a cross signifies that enough of the deposit has been obtained for chemical and microscopical examination. There were a very large number of observations and a large collection of deposits in depths of less than 1000 fathoms; these have usually been close to continental coasts and around oceanic islands, but no attempt has been made on the map to indicate their position by red marks.

The map represents the Indian Ocean and those portions of the Southern and Antarctic Oceans included between the meridians of 20° and 150° east, and is estimated to contain 27,600,000 square miles, 905,900 belonging to the Antarctic, and 9,372,600 to the Southern Ocean. In this area there are 415 reliable soundings of 1000 fathoms and deeper; two-fifths of this number are north of the equator. If we divide the region into an eastern and western part by the 70th meridian of east longitude, then three-fifths of the soundings are found in the western, and two-fifths in the eastern part; the greater number of soundings thus lie in the NW. of the Indian Ocean. By dividing the whole region into squares of 10 degrees each, there are 98 of such squares, 16 of which are north, and 82 south of the equator. Soundings have been taken in 56 of the squares, thus leaving 42 squares in which no information as to depth is at hand; these lie mainly south of the equator, only two being found on its north side. Of the 56 squares in which soundings are known, 22 lie along the coasts, leaving 34 remote from the continental shores. As stated above, there are 415 soundings of 1000 fathoms and deeper; of these 134 are from 1000 to 1500 fathoms (inclusive), 109 of

[1] *Scottish Geographical Magazine*, vol. iii. p. 560.

which are situated in 17 of the 22 shore squares, 25 in 12 of the 34 squares remote from land. 114 soundings have a depth of from 1500 fathoms to and including 2000 fathoms, distributed over 35 squares; of these 60 are situated in the squares near shore, leaving 54 in 22 of the remoter squares. There are 116 soundings ranging from 2000 fathoms to and including 2500 fathoms; 20 of these soundings are found in squares near shore, and 96 in those remote from shore. There are 51 soundings over 2500 fathoms (9 of which are over 3000 fathoms); 8 of these are in squares close to shore, 43 in those situated towards the central regions of the ocean. It thus appears that beyond the 1000-fathom line there is a gradual deepening from the shore, extending southwards and eastwards, the deeper soundings being found in the eastern portion of the region under consideration. The deepest part is, indeed, situated between the equator and the 40th parallel of south latitude. South of this the ocean gradually shallows towards the Antarctic Continent.

The contour lines having been drawn from a careful consideration of all the available data as to the depth, the following are the estimated areas between the various zones of depth:—

From	0 to 100	fathoms =	1,449,800	square miles.
,,	100 to 500	,, =	1,151,700	,,
,,	500 to 1000	,, =	967,900	,,
,,	1000 to 2000	,, =	8,122,100	,,
,,	2000 to 3000	,, =	15,858,700	,,
Over	3000	,, =	49,800	,,
			27,600,000	square miles.

It will thus be seen that the zone between 2000 and 3000 fathoms occupies a much larger portion of the whole area than any of the others, and it is estimated that the mean depth of the whole region is about 2300 fathoms.

I have estimated the area of the land draining into the Indian Ocean at 6,813,600 square miles, and the total amount of rain falling on this land annually at 4379 cubic miles.[1] That portion of this water which returns to the sea by rivers comes chiefly from the continent of Asia, and the detritus which is thus borne to the ocean makes up a very large part of the deposits now forming in the Bay of Bengal and Arabian Sea. A large amount of detrital matter is also borne to the region from the Antarctic continent by the ice which is shed from the land, and floats northwards in the form of large flat-topped icebergs. This detrital matter can be traced in the deposits nearly to the 40th parallel of south latitude. The deposits near the coasts of Africa, Australia, and the East Indian Islands are also largely modified by land detritus, but towards the central parts of the ocean it is difficult to trace the ordinary river detritus in the deposits that are there in process of formation.

The temperature of the water over the bottom in the deeper parts of this ocean is very uniform, and subject to little or no variation. Temperatures of 34°·2 and 33°·7 Fahr. have been observed in the Arabian

[1] *Scottish Geographical Magazine*, vol. iii. p. 75.

Sea and Bay of Bengal at the bottom, and these differ little, if at all, from those recorded by the *Challenger* in 50° south latitude; it is evident, then, that the deep cold water of the Arabian Sea and Bay of Bengal has flowed north along the bottom from the Southern and Antarctic Oceans.

The temperature of the surface waters varies greatly in different parts of these oceans, or at the same localities at different times of the year. In the tropical regions (north of 20° S.) there is usually a high and rather uniform temperature. In all the coral-reef regions this is from 70° to 81° Fahr., and the range throughout the year is often only 7° or 8° Fahr. Off the Cape of Good Hope and off Cape Guardafui the range is sometimes 20° to 30° Fahr. at different seasons or in different states of the wind—the cold deep water being brought to the surface in the latter locality when the wind is off shore.[1] In the Antarctic regions, again, the surface waters have a nearly uniform low temperature at all times. It is probable, from the observations of the *Challenger*, that the dense and warm tropical water which passes southwards along the eastern coasts of Africa into the great Southern Ocean, sinks, on reaching a latitude of about 50° south, to the bottom, and is slowly drawn northwards as a cold current to supply the place of southerly surface currents and evaporation in the tropics, and also southwards to supply the place of the relatively light and cold water that flows north as a surface current from the Antarctic.

These variations in the temperature of the surface waters determine to a large extent the nature of the deposits forming at the bottom, for these are largely composed of the dead shells and skeletons of organisms living in the water at and near the surface, and the species and abundance of these vary according to the temperature and other surface conditions. Diatoms are especially characteristic of the cold surface waters of the Antarctic and Southern Oceans and their siliceous frustules make up a large part of the deposits in these regions. Of pelagic Foraminifera which secrete carbonate of lime for their shells, there are only one or two species in Antarctic waters, whereas there are eighteen or nineteen species of these Rhizopods in the warm surface waters of the tropics. The carbonate of lime which is so abundant in the majority of oceanic deposits, is chiefly derived from the shells of these Foraminifera, together with Coccoliths, Rhabdoliths, and Pteropod and Heteropod shells.

In 113 soundings over 1000 fathoms in depth, the amount of carbonate of lime present in the deposit varies from a trace to 92·34 per cent. 48 of these contain from 0 to 20 per cent.; 11, from 20 to 40 per cent.; 11, from 40 to 60 per cent.; 14, from 60 to 80 per cent.; and 14 have over 80 per cent. Of those containing 0 to 20 per cent., 19 are situated in squares near shore, and have an average depth of 1480 fathoms; 29 are remote from shore, and have an average depth of 2540 fathoms; the latter are red clays or Radiolarian oozes, and the former are terrigenous deposits, largely made up of *débris* from the continents. When remote from land, those with a higher percentage of carbonate of lime have a less depth than those with a lower percentage, in the same latitude.

[1] See *Scottish Geographical Magazine*, vol. iii. p. 560, November 1887.

By reference to the accompanying map, the distribution of the various kinds of deposits throughout the region under consideration will be found to be graphically represented. It is of course understood that for a large part of the area we have no actual observations as to the nature of the deposits, so that the map is largely hypothetical, yet not any more hypothetical than maps showing zones of depth. The observation-spots are, however, all placed on the charts for all soundings of 1000 fathoms and deeper, so that the reader is made aware of the data from which the map has been constructed. Besides the actual examination of the samples procured in the soundings, a knowledge of the depth, the surface conditions, and the nearness or remoteness from land all give, when carefully studied, valuable indications as to the probable limits of the various kinds of deposits in different directions. It is believed that when maps of this kind are constructed for the whole ocean, they will be of the greatest service to all future investigators, for then surveyors will be able at once to point out errors, and in this way our knowledge of these deep-sea deposits and the conditions of deep-sea life will become more and more definite and accurate with each additional observation.

Assuming that the areas marked out by the various colours are approximately correct, then the extent of the areas occupied by the several varieties of deposits will be as follows :—

Oceanic Deposits.	Globigerina ooze,	11,503,000	sq. m.
	Diatom ooze,	5,265,200	„
	Radiolarian ooze,	1,129,400	„
	Red clay,	4,646,000	„
Terrigenous Deposits.	Blue mud,	4,339,400	„
	Coral muds and sands,	387,300	„
	Green sands,	329,200	„
		27,600,000	sq. m.

It is proposed now to make a few remarks on each of these varieties of deposits with the view of indicating their composition and pointing out how each kind merges into the other in adjacent regions.

Globigerina Ooze.—This term has now become quite familiar from the many references to this kind of deposit in popular works on Physical Geography and Geology. It is applied generally to the whitish or rose-coloured mud or ooze, collected in great depths, when this is largely composed of minute calcareous shells. All the shells in such a deposit do not belong to the genus *Globigerina*, but the majority of them usually do, so that the name is at once appropriate and distinctive ; pelagic species of *Pulvinulina*, *Sphæroidina*, *Candeina*, and *Pullenia* are especially abundant in many tropical deposits. If, however, we limit our attention to the eight or nine species of pelagic *Globigerina*, and regard these from the point of view of numbers of individuals belonging to these species, then it appears to me that these greatly outnumber any other genus of organisms on the face of the earth. It does not seem possible to make an exception in favour of the minuter Microzoa, whether on land or in the ocean. The Rhizopods referred to this genus are found everywhere in the surface and sub-surface

waters of the open ocean from the Equator to the Poles; their remains form the larger part of the marine deposits now in process of formation, and probably make up a larger part of geological formations than any other group of organisms. The species and individuals are most abundant and largest in the warm and salter waters of the tropical regions; they diminish in all these respects towards the Poles, where they are represented by one or two dwarfed species. Thus in examining a marine deposit, it is possible to tell approximately the latitude in which it was collected by the species of *Globigerina* that are present.

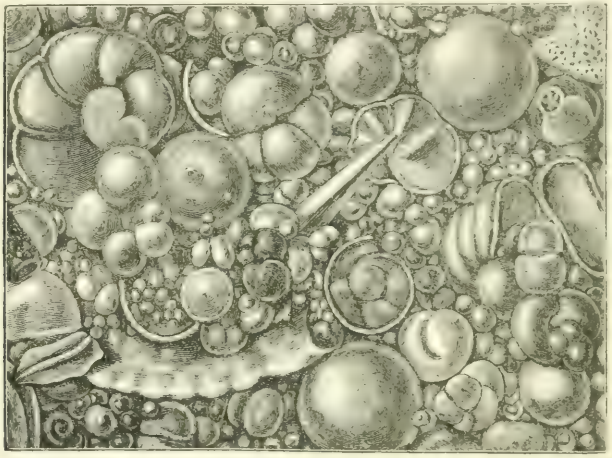


Fig. 1.—Globigerina Ooze, from 1900 fathoms, $\frac{2}{3}$. (From *Ency. Brit.*, 9th ed.)

A Globigerina ooze contains from 30 to over 80 per cent. of carbonate of lime, principally made up of some of the following species of pelagic Foraminifera :—

Orbulina universa, d'Orb.
Globigerina sacculifera, Br.
,, *æquilateralis*, Br.
,, *conglobata*, Br.
,, *dubia*, Egger.
,, *rubra*, d'Orb.
,, *bulloides*, d'Orb.
,, *inflata*, d'Orb.
,, *digitata*, Br.
,, *cretacea*, d'Orb. (?).
Sphæroidina dehiscens, P. & J.
Pullenia obliquiloculata, P. & J.
Hastigerina pelagica, (d'Orb.)
Pulvinulina menardii, (d'Orb.)
,, *tumida*, Br.
,, *canariensis*, (d'Orb.)
,, *micheliniana*, (d'Orb.)
,, *crassa*, (d'Orb.)
Candeina nitida, d'Orb.

In addition to these shells there are usually a few shells of bottom-living species of Foraminifera, such as Biloculinas, Uvigerinas, Truncatulinas, Textularias, and Rotalias, but these rarely make up over two or three per cent. of the whole deposit. Then, again, there may be fragments of Echinoderms, Ostracode shells, otoliths of fish, Coccoliths and Rhabdoliths, but these collectively make up only a relatively small proportion of the carbonate of lime present in the deposit. The residue

left on removal of the carbonate of lime from a typical Globigerina ooze consists of Diatoms, Radiolarians, Sponge spicules, fine amorphous clayey matter, a few small mineral particles, usually not exceeding 0·1 mm. in diameter, generally consisting of fragments of pumice, of felspars, magnetite, augite, hornblende, and volcanic lapilli. This residue is usually reddish or brown from the presence of ferric oxides of iron and peroxide of manganese.

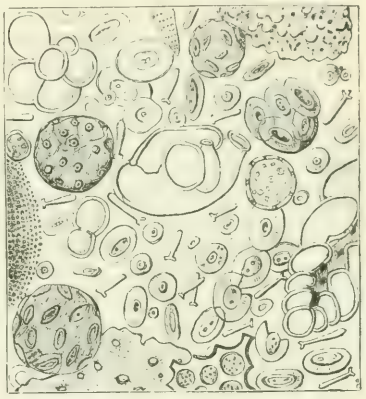


Fig. 2.—The finer particles of a Globigerina ooze, showing Coccoliths, Coccospheres, and Rhabdoliths, $\frac{540}{1}$. (From *Ency. Brit.*, 9th ed.)

All the various elements which go to make up a typical Globigerina ooze are subject to variations in amount with change of position and of conditions, such as variations of surface conditions, of depth, of proximity to land, or to great rivers and to volcanic eruptions either under water or on land. There is thus a gradual transition from a Globigerina ooze into all the other kinds of deposits. It is to be remembered, then, that there is no sharp line separating the one kind of marine deposit from another, as one might be led to suspect from an examination of the accompanying map. Indeed it is often very difficult to say whether a deposit under examination should be called a Globigerina ooze, a Pteropod ooze, a red clay, a Radiolarian ooze, a Diatom ooze, a blue or green mud, or coral mud, so gradually do these deposits merge the one into the other, although the difference between all these is well marked in typical samples.

Pteropod Ooze.—Everywhere in the surface waters of the warmer regions of the ocean there are innumerable pelagic Molluscs, such as Pteropods, Heteropods, and Gasteropods. These have shells much larger than the pelagic Foraminifera, but exceedingly thin and delicate. The dead shells of these creatures are sometimes found in immense numbers in some marine deposits. It is, however, a remarkable fact that they are wholly absent in all the deposits from very deep water, although we know them to be abundant in the surface waters of those very regions. In a typical red clay, Globigerina ooze, or Radiolarian ooze not a trace of these shells is to be found. No typical Pteropod ooze has as yet been found in the Indian Ocean. Had depths of 800, 1000, or 1200 fathoms, however, been met with in the tropical regions far from land, there is little doubt that these shells would have made up a considerable part of the deposit, which would consequently have been entitled to the name of Pteropod ooze. These shells are found in great numbers in the lesser depths near coral islands and in some of the near-shore deposits along the continents, but in these situations they are mixed up with a large quantity of *débris* from the land and from coral reefs. The Pteropod shells are believed to be removed from all the deeper deposits through the solvent action of sea-water on their relatively large but thin and

delicate shells, which present a larger surface to its action than the more compact and thicker, though smaller, Foraminiferous shells. A Pteropod ooze contains from 70 to 90 per cent. of carbonate of lime, and has many more remains of bottom-living organisms than a Globigerina ooze, such as fragments of Echinoderms, Alcyonarians, Corals, Ostracodes, Foraminifera, fish remains, and Mollusc shells.

Coral Muds and Sands.—As a coral island or reef is approached from the open ocean, the water slowly shallows, and with the shallowing and approach to the reefs the character of the deposit alters. Pteropod and Heteropod shells appear in the deposits, so that the Globigerina ooze passes into what might be called a Pteropod ooze were it not for the admixture of remains of reef-forming organisms. These latter gradually increase in abundance as the reef is approached, till they predominate and more or less completely mask the remains of pelagic organisms; the deposit then becomes, near the reefs, a coral mud or sand, composed of fragments of calcareous Algæ, Corals, Molluscs, large Foraminifera, and other organisms. The proportion of carbonate of lime in these deposits sometimes reaches over 90 per cent.

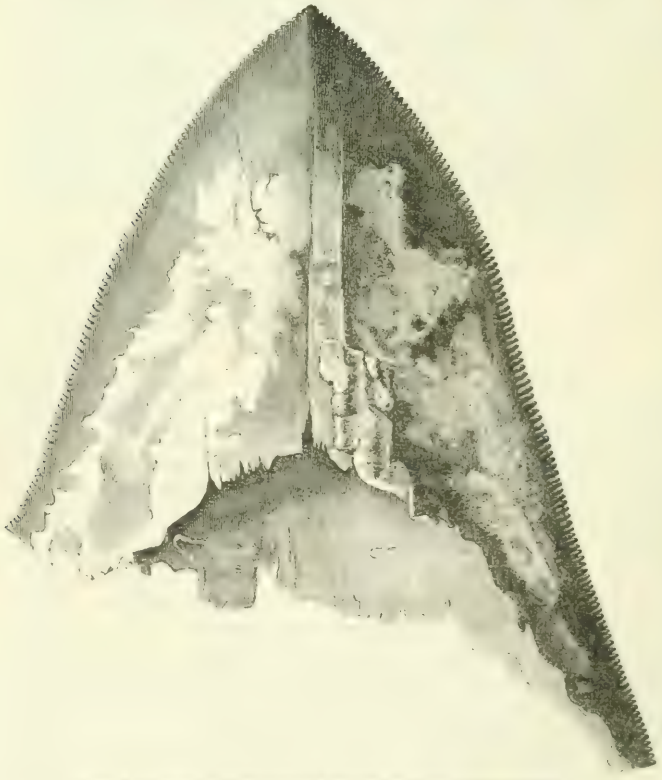


Fig. 8. Tooth of *Carcharodon megalodon*, from 2385 fathoms.

Red Clay.—Just as the proportion of lime in a Globigerina ooze increases, and the remains of calcareous organisms consequently become

more abundant, as the depth becomes less in the open ocean or near coral islands, so, on the other hand, does the proportion of lime-secreting

Fig. 4.—Tooth of *Oxyrhina trigonodon*, from 2350 fathoms.

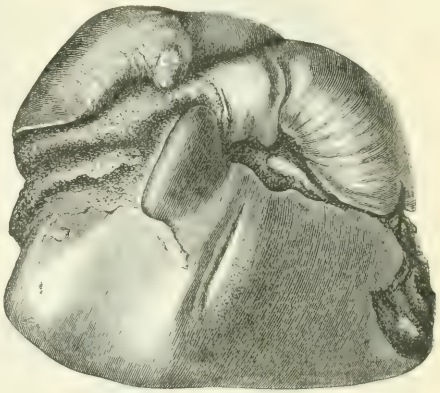


Fig. 5.—Ear-bone of *Ziphius Cavirostris*, from 2335 fathoms.

organisms become less with increasing depth, and the Globigerina ooze passes finally, in regions remote from land, into a red clay or a Radiolarian ooze. The red clay is almost identical in composition with the residue (after removal of the calcareous organisms) of a Globigerina ooze from the same region. Mineral particles are usually very minute; those with a diameter greater than 0·05 mm. do not as a rule make up more than one or two per cent. of the whole deposit. The great bulk of the deposit is exceedingly fine clayey matter, the mineral particles in which do not reach the dimensions above stated. The colour of this clay is red or brown, from the presence of the higher oxides of iron and manganese. In this deposit there is often merely a trace of carbonate of lime, and if microscopic examination shows any calcareous shells, it does not reveal more than one or two broken fragments of Foraminifera. In depths over 3000 fathoms this is usually the case, but in lesser depths what has been called red clay sometimes contains 20 or 30 per cent. of carbonate of lime, consisting of the shells of pelagic Foraminifera and Coccoliths. In some of the red clays of the Pacific Ocean there was a very large quantity of manganese peroxide, in the form of nodules and depositions around sharks' teeth and ear-bones of whales, as well as disseminated in fine grains through the deposit, giving it a dark brown colour. In the same deposits were

Fig. 6.—Section of a Manganese Nodule, showing ear-bone of *Mesoplodon* in the centre, from 2600 fathoms.

many crystals of philipsite, formed *in situ*, together with palagonite and cosmic spherules. Captain Aldrich has discovered a similar area in the centre of the Indian Ocean, about latitude 20° south, and between the meridians of 70° and 90° east longitude, where the deposits are almost

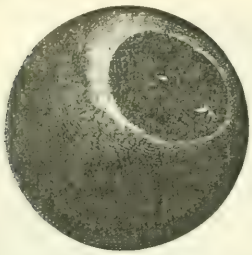


Fig. 7.—Black cosmic Spherule, with metallic nucleus, from 2375 fathoms, $\frac{60}{1}$.

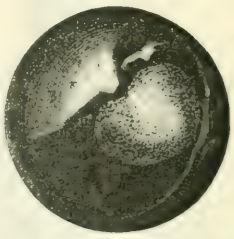


Fig. 8.—Black cosmic Spherule, with metallic nucleus, from 3150 fathoms, $\frac{60}{1}$.

identical with many of those from similar depths in the Pacific. There are indications that volcanic disturbances have taken place at the bottom in these regions, but at a remote period rather than recently.

Radiolarian Ooze.—Some samples of Globigerina ooze contain very few remains of Radiolarians; it is in some exceptional cases difficult to find a trace of them, but usually they are present. In some regions of the Pacific and Indian Oceans they make up a considerable part of the deposit; in these localities the Globigerina ooze passes with increasing depth into a Radiolarian ooze rather than into a red clay. It is at times difficult to say whether a deposit should be called a red clay or a Radiolarian ooze, for there is no difference between these two kinds of deposits except what is due to the greater or less abundance of the Radiolarian spicules and skeletons. When 25 per cent. of the deposit is estimated to consist of these siliceous remains, it is named a Radiolarian ooze; with a less percentage it is called a red clay. A Radiolarian ooze generally contains not more than a trace of carbonate of lime, but it may have 15 to 20 per cent. of carbonate of lime, and this is always due chiefly to the presence of fragments of pelagic Foraminifera. This deposit is found in the greatest depths far from land, and is well represented in the eastern part of the tropical Indian Ocean. It is still more largely developed in the Pacific Ocean, but a typical Radiolarian ooze has not yet been met with in the North and South Atlantic Oceans. Radiolarians appear to be more abundant in those parts of the ocean where there is a relatively low salinity, and are especially

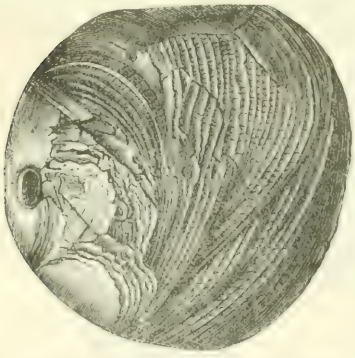


Fig. 9.—Spherule of Bronzite, from 3500 fathoms, $\frac{25}{1}$.

numerous in the Pacific. However, they are always present in the waters of the open ocean, and it is difficult to account for

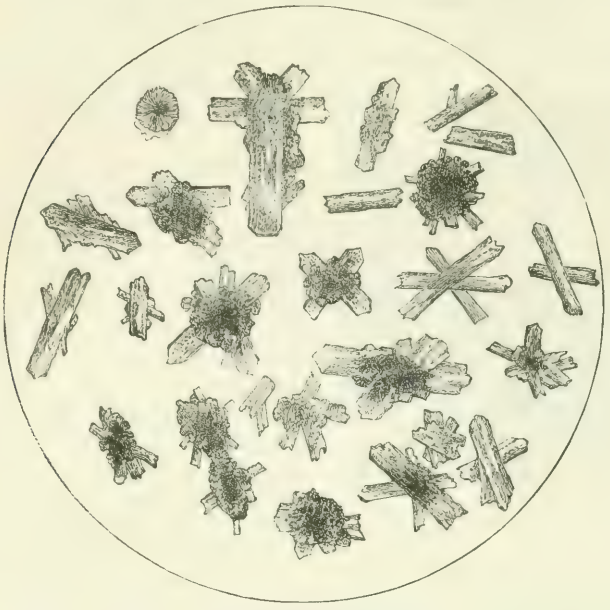


FIG. 10.—Crystals of Philipsite, from the deep water of the Pacific. (From *Ency. Brit.*, 9th ed.)

their complete or almost complete absence from many marine deposits, unless it be admitted that their siliceous remains are re-dissolved by the waters of the ocean. We can from an examination of the skeletons in the deposits see that this process has been going on, just as we observe the gradual breaking up and disappearance of the Globigerina shells in all the greater depths of the ocean. It is not then easy to determine whether the abundance of Radiolarians in some deposits, and their absence in others, is to be attributed to the greater activity of solution in some regions than in others, or to their greater or less abundance in the surface waters of the respective areas; both these circumstances must be taken into consideration in any discussion of the subject.

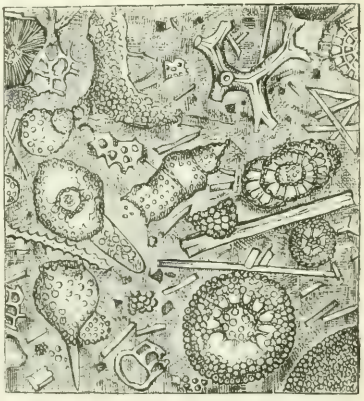


FIG. 11.—Radiolarian ooze, from 4475 fathoms in Central Pacific, $\frac{1}{1}\frac{0}{0}$. (From *Ency. Brit.*, 9th ed.)

DIATOM OOZE.—In passing from the tropical regions of the Indian Ocean to the Southern Ocean and Antarctic, a gradual change is noticed

in the character of the organisms captured in the surface waters by means of the tow-nets. The shelled Pteropods and Heteropods disappear, as well as many of the larger species of Globigerinidæ. Tropical species of Radiolarians give place to those which are characteristic of high and colder latitudes, and Diatoms become so numerous that the nets are often filled with a slimy mass composed almost entirely of those siliceous Algæ. A corresponding change takes place in the character of the deposits in process of formation over the floor of the ocean. The Globigerina ooze is made up of fewer species and smaller shells of pelagic Foraminifera as the Antarctic is approached, while the percentage of Diatom frustules in the deposits increases till the Globigerina ooze passes insensibly into a Diatom ooze, which in a typical example is pure white when dry, and resembles meal or flour. From the observations that have been already made, we have good grounds for believing that this Diatom deposit surrounds the Antarctic in the form of a broad band. It contains from ten to thirty per cent. of calcareous organisms, and, as the deposit is wholly within the region of floating ice, it contains in some places much land *débris*. This is especially the case close to the Antarctic continent, where the *débris* from the land predominates, and a blue mud characteristic of continental shores replaces the Diatom ooze.

Fig. 12.—Diatom ooze, from 1900 fathoms in the Antarctic Ocean, $\frac{2}{1}$⁰. (From *Ency. Brit.*, 9th ed.)

Blue Mud.—In approaching any continental shore or volcanic island from the open ocean, the nature of the deposits changes in a similar manner owing to the admixture of *débris* from the land. The distance from land to which this detritus affects the deposits to any appreciable extent varies greatly. In the Antarctic its influence is widespread owing to the presence of floating ice. In the Bay of Bengal and Arabian Sea, terrigenous matters from the Indus and Ganges are also spread out over a wide extent of the ocean's floor, and this is always the case where large rivers enter the sea. The colour of the clayey matter of typical oceanic deposits is, as we have seen, usually red or brown, but where land influences prevail it is generally bluish; the immediate surface-layer is generally soft and reddish, coloured where the deposit is in contact with the water, but blue, stiff, and tenacious beneath the surface, where a reduction of the higher oxides takes place in consequence of the decomposition of animal matter that is going on in the deeper layers. All these blue muds appear to contain much more organic matter than the more remote oceanic deposits. The percentage of lime in a blue mud varies and is due to the presence of shells belonging to a great variety of organisms. Pelagic Foraminifera are sometimes present in

considerable numbers, but are often wholly absent. There are many indications that blue muds accumulate more rapidly than any of the other deep-sea deposits. The mineral particles vary greatly both as to their nature and size, and often make up 60 to 80 per cent. of the whole deposit. Quartz, which is rare or absent in truly oceanic regions, is abundant along continental shores, together with fragments of minerals derived from ancient geological formations.

Green Muds and Sands.—The fine silt or mud washed into the ocean by great rivers is principally concerned, from its large quantities, in the relatively rapid formation of the blue muds above mentioned; but along high and bold coasts, where no extensive rivers enter the sea, the deposits apparently accumulate much more slowly, and consequently assume a different aspect. The pelagic conditions approach much more closely to the shore, hence the deposits are largely made up of pelagic organisms. Owing to the slower accumulation, the mineral particles from the adjacent continents have been more exposed to the action of the sea, and have undergone much alteration. It is in such situations, as off the south and east coasts of Africa and off the coasts of Australia, that extensive deposits are now in process of formation, which much resemble the green sands of the Cretaceous period. Along all these coasts there is a greenish amorphous matter in the deposits which appears to be organic, as it burns on being heated on platinum foil, leaving a residue of carbon and red oxide of iron. A large proportion of the calcareous shells are filled with glauconitic matter, which remains as a perfect cast on removal of the lime by weak acids. Some of these casts are pale, and others dark green-coloured, the latter giving all the characteristic optical and chemical reactions of true glauconite. In our present seas there are extensive deposits of glauconite now being laid down along high and bold continental shores, removed from the embouchures of large rivers. It is, on the other hand, exceedingly rare to find traces of glauconite in any of the muds where there is an abundant deposit from rivers. This presence or absence of glauconite and glauconitic casts of the calcareous organisms, is, together with the condition and nature of the mineral particles, the chief distinction between what we have called *Green* and *Blue* muds.

Volcanic Muds and Sands differ from Green Muds and Sands found along continental shores in the character of the mineral particles and in the absence of glauconite, the former being all derived from the decomposition of volcanic rocks. The Foraminiferous shells found off the Crozets and off the New Hebrides in the Pacific, are sometimes filled with pale yellow or reddish casts, which in some respects resemble glauconite, but it is very doubtful if any true glauconite is now forming about oceanic volcanic islands or in the deep sea removed from continental shores. It is not easy to be satisfied that the minerals in decomposition in a deposit determine the formation of glauconite in any particular locality, but the distribution here pointed out appears to show an association of this nature.

The foregoing sketch of the marine deposits of the Indian, Southern, and Antarctic Oceans may now be further illustrated by giving a detailed description of a typical sample of each variety from these regions. This will give to those interested in the subject some idea of the methods employed and the labour bestowed on the examination of the available material. In the case of a simple sounding only a few ounces of the deposit are procured, and the other observations at the same spot are usually few in number. In the case of the *Challenger* observations, however, there is usually a much more extensive series of observations at each of the observing stations, so that a rather complete idea may be formed of the conditions of the deep sea in these localities. With the view of illustrating this, a complete description is given of one of the *Challenger* dredging stations in the Southern Ocean. It appears to me that this will give a good idea of the recent advances in oceanographical research, and in our knowledge of the depths of the sea.

H.M.S. *Egeria*. Sounding No. xv. October 30, 1887. Lat. 20° 0′ S., long. 67° 33′ E. 1612 fathoms.

GLOBIGERINA OOZE, fawn colour, homogeneous, coherent when dry.

Carbonate of Calcium (86·85 per cent.), chiefly pelagic Foraminifera, with Coccoliths and Rhabdoliths, Ostracode valves, Echini spines, otoliths of fish.

Residue (13·15 per cent.), ferric red colour.

Siliceous Organisms (2·00 per cent.), Radiolaria, Sponge spicules, a few Diatoms and casts of Foraminifera.

Minerals (7·00 per cent.), mean diameter 0·1 mm., angular; entirely made up of volcanic *débris*, obsidian, and other glassy fragments, magnetite, augite, hornblende, felspars, manganese, a few altered particles.

Fine Washings (4·15 per cent.), amorphous matter, fine mineral particles, fragments of siliceous organisms.

Remarks.—This is a typical *Globigerina ooze* from the tropics. The species of Foraminifera show this very clearly, all the shells of the pelagic species found in the tow-nets at the surface being specially abundant. These tropical species are absent in the deposit from the *Challenger* Station 157 in latitude 53° south, described further on.

The mineral particles are larger and more numerous than in most Globigerina oozes. This is owing to the presence in this region of many splinters of pumice, which I believe to have been derived from pumice floating on the surface of the ocean; these are rubbed and knocked together by the action of the waves, and thus produce a large number of minute fragments which fall to the bottom. After the eruption of Krakatoa very large fields of floating pumice were found all over the Indian Ocean for many months. The following is a list of the Foraminifera found in the deposit, those marked with a cross being pelagic species, which may be compared with the pelagic species similarly

marked from the station in latitude 53° south, where there is a Diatom ooze : [1] —

Biloculina depressa, d'Orb.
,, *depressa*, var. *murrhyna*, Schw.
Miliolina venusta, Karr.
Rhizammina algæformis, Br.
Rhabdammina sp.
Reophax difflugiformis, Br.
,, *guttifera*, Br.
,, *membranacea*, Br.
,, sp.
Haplophragmium latidorsatum, Bornem., young.
Thurammina papillata, Br.
Trochammina lituiformis, Br.
Ammodiscus gordialis, J. & P.
Verneuilina pygmæa, (Egger.)
Gaudryina pupoides, var. *chilostoma*, Rss.
Lagena seminuda, Br.
,, *seminiformis*, Schw.
,, *lagenoides*, var. *tenuistriata*, Br.
,, *acuta*, (Rss.)
,, *globosa*, (Montag.)
,, *desmophora*, Ry. Jones.
,, *alveolata*, Br.
Nodosaria communis, d'Orb.
,, *calomorpha*, Rss.
Cristellaria gibba, d'Orb.
Polymorphina longicollis, Br.
,, *angusta*, Egger.
× *Orbulina universa*, d'Orb.
× *Globigerina rubra*, d'Orb.
× ,, *bulloides*, d'Orb. (?)
× ,, *digitata*, Br.
× ,, *conglobata*, Br.
× ,, *æquilateralis*, Br.
× ,, *sacculifera*, Br.
× ,, *dubia*, Egger.
× ,, *inflata* (? var.)
× *Sphæroidina dehiscens*, P. & J.
× *Pullenia obliquiloculata*, P. & J.
,, *quinqueloba*, Rss.
× *Candeina nitida*, d'Orb.
× *Hastigerina pelagica*, (d'Orb.)
Truncatulina akneriana, (d'Orb.)
,, *ungeriana*, d'Orb.
,, *wuellerstorfi*, (Schw.)
,, *tenera*, Br.
× *Pulvinulina tumida*, Br.
× ,, *menardii*, (d'Orb.)
,, *pauperata*, P. & J.
× ,, *canariensis*, (d'Orb.)
× ,, *micheliniana*, (d'Orb.)
,, *exigua*, Br.
Rotalia orbicularis, d'Orb.
Nonionina umbilicatula, Montag.
,, *pompilioides*, (F. & M.)

H.M.S. *Flying Fish*. Sounding No. XXVIII. January 21, 1887. Lat. 9° 54′ S., long. 97° 42′ E. 3025 fathoms.

RADIOLARIAN OOZE, light brown, homogeneous, slightly coherent when dry. No effervescence was detected on treating the deposit with dilute hydrochloric acid, and no calcareous organisms were observed on microscopic examination, except a few small fragments of teeth of fish.

Siliceous Organisms (60·00 per cent.), chiefly Radiolaria, with Sponge spicules, many Diatoms, and a few arenaceous Foraminifera.

Minerals (10·00 per cent.), mean diameter 0·1 mm., a few particles much larger, and one or two rounded fragments of pumice measuring 2 mm. in diameter, all of volcanic origin and angular, consisting chiefly of scoriaceous and glassy fragments, lapilli, felspar, magnetite, augite, olivine, hornblende, a few flakes of mica, one or two

[1] In these lists the pelagic species are marked with a cross ; the other species are usually represented by only a few specimens. These Foraminifera have been picked out, mounted, and labelled by Mr. Frederick Pearcey, who accompanied the *Challenger* Expedition as Naturalist's assistant.

grains of manganese, some yellow, pale green, brown, and red particles of palagonite.

Fine Washings (30·00 per cent.), amorphous matter, fine mineral particles and fragments of siliceous organisms.

Remarks.—The mineral particles are chiefly minute fragments of pumice with fresh fracture, showing that they had only, in all probability, recently fallen to the bottom. The following arenaceous Foraminifera were observed:—*Hyperammina elongata*, *Aschemonella catenata*, *Haplophragmium latidorsatum*, *Ammodiscus charoides*, *Trochammina pauciloculata*. Among the Radiolaria the Nassellaria are by far the most abundant; this is in marked contrast to the Radiolaria in 53° south latitude, where the Spumellaria predominate.

H.M.S. *Investigator*. Bay of Bengal. Lat. 17° 34′ N., long. 87° 59′ E. 1300 fathoms.

BLUE MUD, bluish grey and very coherent when dry, fine-grained, earthy, homogeneous, lustrous streak.

Carbonate of Calcium (2·94 per cent.), a few pelagic Foraminifera.

Residue (97·06 per cent.), bluish grey.

Siliceous Organisms (3·00 per cent.), a few Radiolaria, Diatoms, and arenaceous Foraminifera.

Minerals (30·00 per cent.), mean diameter 0·05 mm., angular and rounded; felspar, a few grains of quartz, magnetite, olivine, hornblende, zircon, mica, grains of manganese.

Fine Washings (64·06 per cent.), large quantity of amorphous matter, minute mineral particles, and fragments of siliceous organisms.

Remarks.—The fine washings in this deposit are mostly made up of an immense number of minute mineral particles, of angular and rounded form, of the same nature as those mentioned under the heading "Minerals." Their average size is less than 0·02 mm. in diameter. In the washings of the dredge were many small concretions of the deposit held together by depositions of peroxide of manganese. Shells of the following Foraminifera (none of them in any abundance) were also observed in the deposit, in addition to fragments of Gasteropods, Lamellibranchs, Pteropods (one or two), Cephalopod beaks, otoliths of fish, Ostracode valves, Isopods in tubes.

× *Orbulina universa*, d'Orb.
× *Globigerina sacculifera*, Br.
× „ *dubia*, Egger.
× „ *æquilateralis*, Br.
× „ *inflata*, var.
× *Sphæroidina dehiscens*, P. & J.
„ *bulloides*, d'Orb.
× *Pulvinulina menardii*, (d'Orb.)
Pulvinulina pauperata, P. & J.
Rhabdammina abyssorum, Sars.
„ *linearis*, Br.
„ *discreta*, Br.
Hyperammina ramosa, Br.
„ *subnodosa*, Br.
Reophax nodulosa, Br.
„ sp.

Marsipella elongata, Norm.
Haplophragmium latidorsatum (Bornem.)
„ *globigeriniforme*, (P. & J.)
„ *anceps*, Br.
„ *rotulatum*, Br.
„ *turbinatum*, Br.
„ *agglutinans*, (d'Orb.)
Ammodiscus tenuis, Br.
Hormosina globulifera, Br.
Hormosina monile, Br.
„ *ovicula*, Br.
Cyclammina pusilla, Br.
„ *cancellata*, Br.
Trochammina trullissata, Br.
Webbina clavata, J. & P.
Bathysiphon filiformis, Sars.
Clavulina communis, d'Orb.
Biloculina ringens, (Lamk.)
„ *depressa*, d'Orb.
Bulimina contraria, (Rss.)
Cristellaria reniformis, d'Orb.

H.M.S. *Egeria*. Sounding No. xx. Nov. 12, 1887. Lat. 23° 14′ 45″ S., long. 56° 18′ 15″ E. 2466 fathoms.

RED CLAY, dark brown colour, homogeneous, coherent when dry, plastic.

Carbonate of Calcium (12·22 per cent.), chiefly shells of pelagic Foraminifera, with small teeth of fish and Echini spines.

Residue (87·78 per cent.), dark chocolate colour.

Siliceous Organisms (1·00 per cent.), two or three Radiolaria and a few fragments of Sponge spicules.

Minerals (5·00 per cent.), mean diameter 0·1 mm., entirely volcanic, mostly fragments of rock (lapilli), magnetite, felspars, olivine, augite, hornblende, palagonite, manganese grains, glassy fragments, many minute particles of the hardened deposit.

Fine Washings (81·78 per cent.), amorphous matter, fine mineral particles and a few fragments of siliceous organisms.

Remarks.—The carbonate of lime is principally due to the presence of fragments of pelagic Foraminifera, which are marked with a cross in the following list of Foraminifera observed :—

Biloculina depressa, d'Orb.
Miliolina venusta, (Karr.)
Hyperammina algæformis, Br.
Ammodiscus charoides, (J. & P.)
Virgulina schreibersiana, Czjzek.
Cassidulina subglobosa, Br.
Lagena crenata, P. & J.
„ *stelligera*, Br.
„ *gracilis*, Will.
„ *apiculata*, Rss.
„ *lævigata*, (Rss.)
„ *lagenoides*, var. *tenuistriata*, Br.
„ *acuta*, (Rss.)
Lagena sulcata, W. & J.
× *Globigerina dubia*, Egger.
× „ *inflata*, d'Orb.
× „ *sacculifera*, Br.
× „ *conglobata*, Br.
Pullenia quinqueloba, Rss.
Truncatulina pygmæa, Hantk.
„ *wuellerstorfi*, (Schw.)
× *Pulvinulina tumida*, Br.
× „ *menardii*, (d'Orb.)
× „ *micheliniana*, (d'Orb.)
× „ *crassa*, (d'Orb.)
Nonionina pompilioides, (F. & M.)

H.M.S. *Egeria*. Sounding No. XII. October 25, 1887. Lat. 21° 07′ S., long. 77° 49′ E. 2564 fathoms.

RED CLAY—dark chocolate colour, homogeneous, coherent when dry.

There was no trace of Carbonate of Calcium.

Siliceous Organisms (3·00 per cent.), a few Radiolaria and Diatoms.

Minerals (15·00 per cent.), mean diameter 0·15 mm., almost entirely volcanic, chiefly pumice *débris*, many manganese grains, philipsite, magnetite, hornblende, felspar, augite, many glassy fragments.

Fine Washings (82·00 per cent.), amorphous matter, fine mineral particles, oxides of iron and manganese.

Remarks.—The mineral particles were almost all minute fragments of pumice, with fresh fractures, and were larger and more numerous than in most typical red clays. Manganese peroxide appears to have been very abundant in this locality.

H.M.S. *Challenger*. Station 142. December 18, 1873. Lat. 35° 4′ S., long. 18° 37′ E. 150 fathoms.

GREEN SAND, with white spots, fine-grained, pulverulent and slightly coherent when dry.

CARBONATE OF CALCIUM (67·75 per cent.), chiefly pelagic Foraminifera (40 per cent.), with bottom-living Foraminifera (10 per cent.) and otoliths, teeth, fragments of bones of fish, *Serpula* tubes, Gasteropods, Lamellibranchs, Pteropods, Ostracodes, Echinoderm fragments, Polyzoa, Coccoliths (17 per cent.).

RESIDUE (32·25 per cent.), green and arenaceous.

Siliceous Organisms (7·00 per cent.), Sponge spicules, grey and green casts of Foraminifera, Diatoms, arenaceous Foraminifera.

Minerals (20·00 per cent.), mean diameter 0·3 mm., angular and rounded; quartz, glauconite, felspar, hornblende.

Fine Washings (5·25 per cent.), amorphous matter, fine mineral particles and fragments of siliceous organisms.

Remarks.—There were a very large number of invertebrate animals of all kinds in the dredgings at this station. Fifty-five new species, some of them belonging to new genera, are described in the *Challenger* Reports. There was much green-coloured matter in the deposit; some portions resembled vegetable tissue, and when heated on platinum-foil burned like an organic substance, becoming black, then red.

Glauconite is exceptionally well represented in this deposit on the Agulhas Bank. The grains are about one millimètre in diameter, and are isolated or agglommerated into nodules; they are always rounded, often mammillated, are hard and dark green, black or brown in colour; their surface is sometimes shining. The internal casts of the Foraminifera and other calcareous organisms are sometimes dirty white or pale green, and sometimes dark green, in every way like the larger mammillated glauconite particles, which latter often show rudely the form of the

calcareous organisms. It seems undoubted that a large number of the characteristic glauconite grains have had their origin from the internal pale-coloured casts of the Foraminifera. In the dredgings were many glauconitic concretions containing phosphate of lime, and in most respects resembling concretions from the green sand.

The shells of several species of Pteropods belonging to *Cleodora* and *Spirialis*, together with the following Foraminifera were found in the deposit :—

Biloculina sphæra, d'Orb.
,, *ringens*, (Lamk.)
Miliolina seminulum, (Linn.)
,, *circularis*, (Bornem.)
,, *venusta*, (Karr.)
,, *agglutinans*, (d'Orb.)
Psammosphæra fusca, Schulze.
Rhabdammina abyssorum, Sars.
Hyperammina friabilis, Br.
Marsipella cylindrica, Br.
Rhizammina algæformis, Br.
Reophax dentaliniformis, Br.
,, *fusiformis*, (Will.)
Haplophragmium agglutinans, (d'Orb.)
,, *turbinatum*, Br.
Textularia aspera, Br.
,, *sagittula*, Defr.
Bulimina aculeata, d'Orb.
,, *marginata*, d'Orb.
,, *inflata*, Seg.
,, *pyrula*, d'Orb.
,, *punctata*, d'Orb.
Cassidulina lævigata, d'Orb.
Polymorphina myristiformis, W ll.
Lagena alveolata, var. *substricta*, Br.
,, *sulcata*, (W. & J.)
,, *sulcata*, var. *interrupta*, Will.
,, *marginata*, (W. & B.)
Nodosaria (*Glandulina*) *lævigata*, d'Orb.
,, ,, *æqualis*, Rss.
,, *radicula*, (Linn.)
,, *consolbrina*, var. *emaciata*, Rss.
,, *scalaris*, (Batsch.)
,, *perversa*, Schw.
Cristellaria obtusata, var. *subalata*, Br.
Cristellaria rotulata, (Lamk.)
Vaginulina linearis, (Montag.)
Marginulina costata, Batsch.
Uvigerina schwageri, Br.
,, *tenuistriata*, Rss.
,, *angulosa*, Will.
Sagrina striata, Schw.
× *Orbulina universa*, d'Orb.
× *Globigerina bulloides*, d'Orb.
× ,, *bulloides*, var. *triloba*, Rss.
× ,, *sacculifera*, Br.
× ,, *æquilateralis*, Br.
× ,, *conglobata*, Br.
× ,, *dubia*, Egger.
× ,, *inflata*, d'Orb.
× ,, *rubra*, d'Orb.
× *Sphæroidina dehiscens*, P. & J.
,, *bulloides*, D'Orb.
× *Pullenia obliquiloculata*, P. & J.
Anomalina ariminensis, (d'Orb.)
,, *coronata*, P. & J.
Truncatulina lobatula, (W. & J.)
,, *refulgens*, (Montf.)
,, *haidingeri*, d'Orb.
Rotalia sp.
,, *orbicularis*, d'Orb.
× *Pulvinulina menardii*, (d'Orb.)
× ,, *canariensis*, (d'Orb.)
× ,, *micheliniana*, (d'Orb.)
,, *oblonga*, (Will.)
,, *umbonata*, Rss.
,, *elegans*, (d'Orb.)
Operculina ammonoides, (Gron.)
Nonionina sp.
Polystomella macella, (F. & M.)

H.M.S. *Challenger*. STATION 151. February 7, 1874. Lat. 52° 59′ 30″ S., long. 73° 33′ 30″ E. 75 fathoms.

VOLCANIC MUD—greenish black.

CARBONATE OF CALCIUM (2·58 per cent.), *Serpula* tubes, Gasteropods, Lamellibranchs, Ostracodes, Echinoderm fragments, and Polyzoa (1·58 per cent.), pelagic and bottom-living Foraminifera (1·00 per cent.).

Residue (97·42 per cent.).

Siliceous Organisms (10·00 per cent.), Radiolaria, Sponge spicules, and Diatoms.

Minerals (70·00 per cent.), mean diameter 0·6 mm., angular and rounded; fragments of brown and red glass, often enclosing microliths of olivine, felspar (plagioclase), augite, magnetite.

Fine Washings (17·42 per cent.), small quantity of amorphous matter, many fine mineral particles, flocculent organic matter, fragments of Sponge spicules and of Diatoms.

Remarks.—The Diatoms in this deposit were especially abundant for a shore deposit, but in the tow-nets at the surface they were also very abundant. In the dredging at this depth, off Heard Island, there was a very large number of animals belonging to all the Invertebrate groups; over forty new species of animals, some of them belonging to new genera, are described in the *Challenger* Reports from this Station.

FULL DESCRIPTION OF A *CHALLENGER* DREDGING STATION.

Station 157. (Sounding 261.) South-West of Australia.

March 3, 1874; lat. 53° 5′ S., long. 108° 35′ E.
Temperature of air at noon, 38°·3. Mean for the day, 36°·9.

	At surface.	At 50 faths.	At 100 faths.	At bottom.
Temperature of Water,	37°·2	36°·6	32°·8	32°·2?
Density at 60° Fahr.,	1·02509	1·02507	1·02537	1·02561

Depth, 1950 fathoms; deposit, Diatom ooze.

At 6.30 A.M. shortened and furled sails and proceeded under steam to trawl and sound. At 8 A.M. put over trawl, and at 9 A.M. sounded in 1950 fathoms. A small quantity of Diatom ooze came up in the sounding tube. The distance from Cape Otway at noon was 1721 miles. The amount of current during the past three days was 55 miles, direction N. 19° E. Several temperatures were taken down to 500 fathoms. Samples of water were taken from depths of 50 and 100 fathoms. The carbonic acid was determined in the bottom water, and amounted to 44·3 mgrm. per litre. The tow-nets, which were dragged at the surface of the sea and a few fathoms beneath, came up nearly filled with a slimy mass consisting almost entirely of Diatoms; besides the Diatoms there were many Radiolarians, a few Copepods, Cypridinidæ, Hyperidæ, Pteropods, and pelagic Foraminifera. At 2 P.M. commenced heaving in trawl; it came up at 4 P.M. with a large quantity of the Diatom ooze, many large and small stones, and numerous animals. This was one of the most successful hauls of the expedition. A few of the usual sea-birds were observed during the day. Wind fell to a calm during the afternoon. There was a brilliant sunset, and at 11·45 P.M. a fine aurora australis, stretching in four concentric arcs over the SE. to W. horizon.

Detailed Description of the Deposit.

The Diatom ooze which came up in the trawl was of a yellowish, straw, or cream colour when wet. The intestines of many of the Holothurians and Annelids were seen to be filled with this ooze through the transparent bodies of the animals. Some portions of this deposit were somewhat coherent and adhered in laminated fragments when first taken from the trawl, being apparently the deeper layers of the deposit, but the larger portion of the deposit was of an oozy or watery consistence. It effervesced with weak acids. This ooze tended to sort itself very quickly when placed in water, the extremely fine particles remaining suspended in the water, while the larger mineral particles, Foraminifera, and larger Radiolarians, fell to the bottom layers of the bottles in which the ooze was preserved. In consequence of this there is a great difference in the quantity of carbonate of lime in samples taken from the same bottle; some samples giving 5 or 6 per cent., while other samples give about 25 per cent. Carefully selected samples, which do not seem to have undergone any sorting, give about 18 per cent. The large quantity of the deposit brought up in the trawl allows of a very much more detailed description being given than at any of the other stations where a Diatom ooze was met with. Nearly the whole of the deposit was carefully sifted, but a considerable quantity was brought home in the condition in which it was taken from the bag of the trawl.

When this ooze is dried it is nearly pure white, or has a very delicate cream colour. It is very light, soft to the touch, coherent under pressure, takes the impress of the fingers, and soils them in the same way as flour. It resembles closely the purest examples of diatomite of fresh-water origin. The following is a description of an average sample of the deposit :—

Carbonate of Calcium (18·19 per cent.) consists chiefly of *Globigerina bulloides* and *Globigerina dutertrei*, a few *Globigerina inflata* and *Pulvinulina micheliniana*; a few bottom-living Foraminifera, spines of Echini, fragments of Polyzoa, Ostracodes, otoliths of fish, and rarely beaks of Cephalopods with small fragments of Gasteropod and Lamellibranch shells.

Residue (81·81 per cent.), white, consists of—

Siliceous Organisms (50·00 per cent.), Diatoms principally, many Radiolarians, some Sponge spicules and arenaceous Foraminifera.

Minerals (3·00 per cent.), mean diameter 0·07 mm., angular; quartz, felspar, hornblende, a few magnetic particles, glassy fragments, and small fragments of palagonite.

Fine Washings (28·81 per cent.).—Composed essentially of the frustules of Diatoms and their fragments, a small quantity of argillaceous matter and very minute mineral particles.

In the following analysis of an average sample of the deposit the silica soluble in hydrochloric acid (HCl) must be considered as almost exclusively coming from the Diatoms and other siliceous organisms. The carbonate of lime comes principally from the Foraminifera present in the

deposit. The insoluble part, which is given *en bloc*, proves only the presence of silicates.

In treating the siliceous remains in a water-bath with hydrochloric acid for more than twelve hours, we succeeded in obtaining only 3·00 per cent. of silica in solution. The numbers given here by Professor Brazier indicate that the siliceous residue after the attack with HCl has been treated with caustic potash.

Analysis of a Dried Specimen of Diatom ooze (Brazier).

Loss on ignition after washing and drying at 230° Fahr.,			= 5·30
Portion soluble in hydrochloric acid = 85·28.	=	Alumina,	= 0·55
		Ferric oxide,	= 0·39
		Calcium phosphate,	= 0·41
		Manganese oxide,	= trace
		Calcium sulphate,	= 0·29
		Calcium carbonate,	= 19·29
		Magnesium carbonate,	= 1·13
		Silica,	= 67·92
Portion insoluble in hydrochloric acid = 4·72.	=	Consisting of alumina and ferric oxide with silica,	= 4·72
			100·00

Rock Fragments from the Trawl.

The largest fragment of rock measures about 50 × 40 × 40 cm., and weighs more than 20 kilogrammes. It is a grey gneiss, fine-grained, and the fracture takes place parallel to the micaceous layers. Some layers are specially composed of mica, while others are more felspathic and granitic, the grains being about 2 or 3 mm. in diameter. The quartz appears to be the dominant element in the rock. The mica is biotite, sometimes presenting a slightly greenish tint. With the microscope the felspathic element is at once seen to be orthoclase and frequently microcline. There were several smaller pieces of rock of the same species as this larger fragment, one being 7 × 6 × 6 cm. Some of them, however, were more micaceous. Two of the fragments had distinct glacial markings. One fragment of basaltic volcanic rock is about 6 × 4 × 2 cm., and has sharp angles; it is hard, compact, and composed of plagioclase, augite (rather rare), magnetite, with the base transformed into a yellowish green matter.

There were more than thirty fragments of pumice with a diameter of from 1 to 3 cm., a few of them being much decomposed. Some are white in the fracture, others are red or black, and in the latter case are iridescent. The less scoriaceous specimens are rounded, the more porous are somewhat angular owing to the large size of the vacuoles. One large piece of pumice appears to be stratified, decomposition having been less rapid in the harder layers.

There seems little doubt that the fragments of gneiss above referred to have been transported from Antarctic land by floating ice. The largest fragment and some of the smaller ones were only partially imbedded in the deposit, the depth to which they were imbedded being

marked by a sharp line. The portions above the surface of the deposit had a slight coating of the black oxide of manganese, and had Foraminifera (*Hyperammina vagans*, Brady), Actiniæ, Annelids, and Polyzoa growing on them. Some fragments of Hexactinellid spicules had a rather thick coating of manganese peroxide.

The Diatomaceæ. (Castracane, Bot. Chall. Exp., vol. ii. pt. iv.)

Considerable differences are recognisable between the general appearance of Diatom preparations made from surface gatherings as contrasted with those procured from the ooze forming the bottom in this locality. By far the most abundant species at the surface was the peculiar, very elongated, flexuous *Thalassiothrix longissima*, var. *antarctica*, Cleve and Grunow (=*Synedra thalassiothrix*, Cl. *in parte*), representatives of which have already been recorded as forming large floating masses in the Arctic Ocean.[1] In the Antarctic its frustules were found arranged in little bundles—from ten to twelve together—fastened together loosely at one end, but separate at the other, the whole being loosely twisted into a spindle. In preparations isolated frustules of it occur but rarely; often two are found closely apposed, but not uncommonly three, four, or even more are so placed. It is, perhaps, with *Chætoceros janischianum*, Cstr., the most characteristic species found on the surface.

The Chætocerotidæ and Rhizosoleniæ are found abundantly in the surface waters, but they are only represented by the terminal calyptræ of the latter in the bottom ooze. Most of the delicately curved though often large forms of *Corethron* and the singular cylindrical *Dactyliosolen* have only been found in surface gatherings, whilst the remarkable *Trachysphenia australis*, Petit, var. *antarctica* (Schwarz) [= *Fragilaria antarctica*, Cstr.], which abounds in the ooze, is much less common in the surface gatherings. Frustules of *Coscinodisci* and *Actinocycli* are also much less numerous at the surface than upon the bottom, but no species which is present in the superficial waters is absent from the ooze.

The contents of the alimentary canals of several of the Echinoderms and Annelids were examined with the view of ascertaining whether or not a predilection was exhibited by the animals for any particular species of Diatoms; it was found, however, that they made use of the ooze as a whole, in all probability taking in the uppermost layers containing specimens recently precipitated from the surface, which may still have contained traces of organic matter. The tubes of the Annelids and the tests of the Foraminifera, *Reophax nodulosa* and *Bathysiphon filiformis*, contained many of the large *Coscinodisci*.

The frustules, which Count Castracane has indicated as "*Fragilaria?* an *Terebraria?* sp.,"[2] may be regarded as the southern representative of *Fragilaria oceanica*, Cl., from the Arctic Ocean, with which it shows in the general arrangement and character of the frustules a considerable amount of agreement. Among the Diatoms observed at this Station the following have been also recorded in the Arctic zone:—[3]

[1] *Bihang til K. Svensk. Vetensk. Akad. Handl.* Bd. i., No. 13, Stockholm, 1873.

[2] Bot. Chall. Exp., part iv. p. 47, pl. xxv. fig. 1.

[3] I am obliged to Mr. John Rattray for preparing and naming the list of Diatoms.

Rhizosolenia setigera, Brightw.
„ *styliformis*, Brightw.
Chætoceros decipiens, Cl.
Coscinodiscus decrescens, var. *polaris*, Grun.
Coscinodiscus decrescens, var. *repleta*, Grun.
„ *subtilis*, var. *glacialis*, Grun.

Among the more peculiarly Antarctic species found at this Station may be noted the following :—

Navicula subtilis (Greg) [=*Pinnularia criophila*, Cstr.]
Trachysphenia australis, Petit, var. *antarctica* (Schwarz.) [=*Fragilaria antarctica*, Cstr.]
Rhizosolenia inermis, Cstr.
Dactyliosolen antarcticus, Cstr.
Chætoceros remotum, Cl. et Grun. [=*Chætoceros janischianum*, Cstr.]
Chætoceros remotum, Cl. et Grun., broad var.
Chætoceros boreale, Bail., var. *brightwellii*, Cl. [=*C. criophilum*, Cstr.]
Synedra lanceolata, Cstr.
Diatoma rhombicum, O'Me., var. *oceanica*, nov.
Corethron criophilum, Cstr., et var.
„ *murrayanum*, Cstr.
„ *hispidum*, Cstr.
Coscinodiscus lunæ [=*Coscinodiscus cycloteres*, Cstr.]
Actinocyclus oliveranus, O'Me.

The following is a list of the principal species that have been observed :—

(*A.*) *From the Surface-Net Gatherings.*

Navicula subtilis (Greg.) [=*Pinnularia criophila*, Cstr.].
Pleurosigma antarcticum (fide Grun.).
Amphiprora antarctica (fide Grun.).
Thalassiothrix longissima, var. *antarctica*, Cl. et Grun. [=*Synedra thalassiothrix*, Cl., in parte].
Trachysphenia australis, Petit, var. *antarctica* (Schwarz) = *Fragilaria antarctica*, Cstr., *Fragilaria* (?) an *Terebraria* (?) sp., Cstr.
Rhizosolenia inermis, Cstr.
„ *setigera*, Btw.
„ *styliformis*, Btw.
Dactyliosolen antarcticus, Cstr.
Chætoceros decipiens, Cl.
.. *remotum*, Cl. et Grun., broad var.
„ *remotum*, var. *robusta*, nov.
„ *remotum*, var. *biaurta*, nov.
Chætoceros boreale, Bail., var. *brightwellii*, Cl.
„ *atlanticum*, Cl.
„ *atlanticum*, var. *attenuata*, Cl. et Grun.
„ *antarcticum*, Grun.
„ *dispar*, Cstr.
„ *sigmoidea*, n. sp.
Corethron hispidum, Cstr.
„ *murrayanum*, Cstr.
„ *criophilum*, Cstr. et var.
Hemiaulus antarcticus, Ehrenb. [=*Eucampia balaustium*, Cstr.].
Actinocyclus oliveranus, O'Me., et forma minor.
Coscinodiscus lunæ, Ehrenb.
„ *excentricus*, Ehrenb.
„ *lineatus*, Ehrenb.
„ *lentiginosus*, Janisch.
.. *tumidus*, Janisch.

(*B.*) *From the Ooze obtained in the Trawl.*

Navicula subtilis, Greg.
Thalassiothrix longissima, var. *antarctica*, Cl. et Grun.
Synedra lanceolata, Cstr.
„ *nitzschioides*, Grun.
„ *filiformis*, Grun.

Thalassionema nitzschioides, Grun., var. *lanceolata*, Grun.
Trachysphenia australis, Petit, var. *antarctica*, Schwarz.
Diatoma rhombicum, O'Me.
Nitzschia constricta, var. *antarctica*, nov.
Rhizosolenia styliformis, Brightw.
„ *furcata*, n. sp.
Corethron criophilum, Cstr.
Hemiaulus antarcticus, Ehrenb. = *Eucampia balaustium*, Cstr., *Eucampia balaustium*, var. *minor*, Cstr.
Asteromphalus hookerii (Ehrenb.) Ralfs.
„ forma *buchii*, Ehrenb.
„ forma *humboldtii*, Ehrenb.
„ forma *cuvierii*, Ehrenb.
„ forma *denarius*, Janisch.
„ *darwinii*, Ehrenb.
Hyalodiscus radiatus, O'Me., var. *arctica*, Grun.
Actinocyclus oliveranus,[1] O'Me.
Coscinodiscus margaritaceus, Cstr.
„ *lunæ*, Ehrenb.
„ *excentricus*, Ehrenb.
„ *atlanticus*, Cstr.
„ *atlanticus*, var., Cstr.
„ *lineatus*, Ehrenb.
Coscinodiscus lentiginosus, Janisch.
„ *lentiginosus*, var. *maculata*, Grun.
„ *africanus*, var. *wallichianus*, Grun.
„ *subtilis*, Ehrenb.
„ *subtilis*, var. *glacialis*, Grun.
„ *tumidus*, Janisch.
„ *tumidus*, var. *fasciculata*, nov.
„ *radiatus*, Ehrenb.
„ *decrescens*, var. *polaris*, Grun.
„ *decrescens*, var. *repleta*, Grun.
„ *fasciculatus*, A. S.
„ *griseus*, var. *gallopagensis*, Grun. (?)[2]
„ *curvatulus*, *maculata*, nov.
„ *tuberculatus*, Grev., var. *excentrica*, nov.
„ *tuberculatus*, var. *antarctica*, nov.
„ *elegans*, Grev.
„ *robustus*, Grev.
„ *robustus*, var. *minor*.
„ *antarcticus*, Cstr. (nov. Grun.)
„ *denarius*, A. S.
„ *marginatus*, Ehrenb.

Analysis of Diatomaceæ from the Deposit (Sipöcz).

The following analysis is, properly speaking, one of that portion of this deposit comprised under the headings "*Siliceous organisms*" and "*fine washings*." The substance sent for analysis had been treated with dilute hydrochloric acid (HCl) to remove the calcareous organisms, and consisted as nearly as possible of siliceous organisms, chiefly Diatoms, but mixed up with these were a few Radiolaria and Sponge spicules. The mechanical separation was not, however, complete, as is shown by the figures below.

The analysis agrees well with the description, for besides siliceous organisms, a small quantity of argillaceous matter and mineral particles

[1] The detached outer rims of this elegant species occur frequently in preparations.

[2] A few specimens occur in the ooze, which, though not absolutely identical with this form as figured by van Heurck (*Synop. d. Diat. d. Belg.*), are yet more closely allied to it than to any other.

is indicated. Considering the low percentage of all the bases it may be concluded that almost all the silica exists in the form of siliceous organisms.

I. 0·5618 grm. Diatomaceæ, dried at 120° C., gave 0·0330 grm. loss on ignition, then treated with fluorhydric and sulphuric acids gave 0·5092 grm. silica (SiO_2), 0·00112 grm. barium oxide (BaO), 0·0056 grm. potassium chloride (KCl) and sodium chloride (NaCl), which gave 0·0044 grm. potassio-bichloride of platinum (K_2PtCl_6) = 0·00134 grm. potassium chloride (KCl) consequently = 0·00085 grm. potassium oxide (K_2O), and 0·00426 grm. sodium chloride (NaCl) consequently = 0·00225 grm. sodium oxide (Na_2O).

II. 0·6487 grm. Diatomaceæ, dried at 120° C., gave 0·0379 grm. loss on ignition, and then treated with fluorhydric and sulphuric acids gave 0·5870 grm. silica (SiO_2), 0·0013 grm. barium oxide (BaO), 0·0057 grm. iron peroxide (Fe_2O_3), 0·0089 grm. alumina (Al_2O_3), 0·0022 grm. lime (CaO), and 0·0055 grm. pyrophosphate of magnesia ($P_2O_7Mg_2$) = 0·00198 grm. magnesia (MgO), and traces of phosphoric acid (P_2O_5).

	I.	II.	Mean.
Silica (SiO_2),	90·63	90·49	90·56
Iron peroxide (Fe_2O_3),	...	0·88	0·88
Alumina (Al_2O_3),	...	1·31	1·31
Lime (CaO),	...	0·33	0·33
Baryta (BaO),	0·20	0·20	0·20
Magnesia (MgO),	...	0·30	0·30
Potash (K_2O),	0·15	...	0·15
Soda (Na_2O),	0·40	...	0·40
Phosphoric acid (P_2O_5),	trace	trace	trace
Loss on ignition (H_2O),	5·87	5·84	5·85
	97·25	99·35	99·98

The Foraminifera. (Brady, Zool. Chall. Exp., vol. ix. pt. xxii.)

The carbonate of lime in the deposit consists chiefly of the shells of pelagic Foraminifera which have fallen to the bottom from the surface, especially the dwarfed forms like *Globigerina dutertrei*, many of the specimens of which scarcely differ from the Arctic *Globigerina pachyderma* in size and contour, and *Globigerina inflata*; although in the following list the bottom-living species, with carbonate of lime shells, are more numerous than the pelagic species, yet the number of individuals are relatively very few in number, the list having been compiled from the examination of a very large quantity of the deposit. While the shells of the pelagic forms are very small when compared with those found in tropical areas, the Miliolidæ, Astrorhizidæ, Lituolidæ, and other bottom-living forms are, on the other hand, represented by very large and beautiful forms. Some specimens of *Miliolina* were one-eighth of an inch in diameter; specimens of *Reophax* and *Rhabdammina* are over one inch in length. Among the arenaceous species there are many interesting illustrations of the mode in which these Rhizopods select and arrange the various par-

ticles in the deposit to form their tests. *Astrorhiza crassatina* here forms its test almost exclusively of the spherical Radiolarian *Cromyosphæra antarctica; Storthosphæra* selects the finest mineral particles, with an occasional larger particle of quartz or palagonite; one form selects only the shells of the pelagic Foraminifera, and another only the smallest Diatomaceæ; *Reophax nodulosa* and *Bathysiphon filiformis* make use of many large *Coscinodisci*, arranging them flatways over the surface, and *Rhabdammina abyssorum* forms its tube of the larger angular fragments of quartz, felspar, magnetite, and other mineral particles. The following 37 genera and 67 species have been observed in the deposit:—

Biloculina depressa, d'Orb.
„ *irregularis*, d'Orb.
„ *ringens* (Lamk.).
„ *sphæra*, d'Orb.
Miliolina oblonga (Montag.).
„ *venusta* (Karr.).
„ *seminulum* (Linn.).
„ *circularis* (Bornem.).
„ *fichteliana* (d'Orb.).
Keramosphæra murrayi, Br.
Astrorhiza crassatina, Br.
Storthosphæra sp. (?).
Pelosina rotundata, Br.
Hyperammina vagans, Br.
Rhabdammina abyssorum, Sars.
„ *discreta*, var. *silicea*, Br.
Rhizammina algæformis, Br.
„ sp.
Saganella (?) sp.
„ (?) sp.
Reophax pilulifera, Br.
„ *nodulosa*, Br.
„ *scorpiurus*, Montf.
„ *adunca*, Br.
Bathysiphon filiformis, Sars.
Haplophragmium latidorsatum, Bornem.
Placopsilina vesicularis, Br.
Thurammina papillata, Br.
„ *compressa*, Br.
„ *albicans*, Br.
Hormosina ovicula, Br.
Ammodiscus charoides, (J. and P.).
Trochammina pauciloculata, Br.
Webbina clavata, J. and P.
Cyclammina cancellata, Br.
Verneuilina pygmæa, Egger.
Gaudryina pupoides, d'Orb.
Clavulina communis, d'Orb.
Pleurostomella brevis, Schwg.
Cassidulina subglobosa, Br.
„ *crassa*, d'Orb.
Lagena alveolata, Br.
„ *lævis* (Montag).
„ *lævigata* (Rss.).
„ *globosa* (Montag).
Nodosaria communis, d'Orb.
Cristellaria convergens, Bornem.
„ *crepidula* (F. and M.).
„ *dilute-striata*, Gümb.
Polymorphina angusta, Egger.
„ *thouini*, d'Orb.
Uvigerina pygmæa, d'Orb.
× *Globigerina bulloides*, d'Orb.
× „ *inflata*, d'Orb.
× „ *dutertrei*, d'Orb.
× „ *pachyderma* (Ehrenb.).
Pullenia sphæroides (d'Orb.).
Spirillina decorata, Br.
Truncatulina ungeriana (d'Orb.).
„ *lobatula*, (W. and J.)
„ *pygmæa*, Hantk.
Anomalina grosserugosa (Gümb.).
Pulvinulina patagonica (d'Orb.).
× „ *crassa* (d'Orb.).
× „ *micheliniana* (d'Orb.).
„ *exigua*, Br.
Rotalia soldanii, d'Orb.
Nonionina pompilioides (F. and M.).

Radiolaria. (Haeckel, Zool. Chall. Exp., vol. xviii. pt. xl.)

(*A.*) *From the surface-net gatherings.*

In striking contrast to the wealth of forms in the deep-sea deposit at

this station is the uniformity of the Radiolarian surface fauna. This doubtless arises from the fact that the tow-nets were only dragged through a relatively small distance of the surface waters, whereas the deposit at the bottom represents the accumulation of forms which have fallen from the surface during an immense period of time. The absence of some species of Acantharia and Phæodaria in the deposit, when compared with their relative abundance in the surface-net gathering, is to be accounted for by the structure and composition of the skeletons, which are more readily dissolved after the death of the animal. Certain species of Acantharia and Phæodaria are the more abundant here, and these are very rich in individuals. Of the Acantharia the most abundant are *Acanthonia claparedei*, *Acanthostaurus purpurascens* and *Amphilonche lanceolata*; of the Phæodaria, *Challengeron pearceyi*, *Challengeron swirei*, *Challengeron balfouri* and *Challengeron richardsii*.

List of Species from Surface Nets.

I.—Spumellaria.

a. Sphæroidea.

Styptosphæra spongiacea, Hkl.
Acanthosphæra antarctica, Hkl.
Cromyomma perspicuum, Hkl.
Rhizosphæra trigonacantha, Hkl.
„ *antarctica*, n. sp.

b. Discoidea.

Porodiscus flustrella, Hkl.
Stylodictya multispina, Hkl.
Euchitonia muelleri, Hkl.
Stylotrochus challengeri, n. sp.

II.—Acantharia.

Acanthonia claparedei, Hkl.
Acanthostaurus purpurascens, Hkl.
Amphilonche lanceolata, Hkl.
Porocapsa coronodon, Hkl.

III. Nassellaria.

Dictyospyris tetrastoma, Ehrenb.
Cyrtocalpis ovulum, Hkl.
Cornutella clathrata, Ehrenb.

IV. Phæodaria.

Dictyocha stapedia, Hkl.
Distephanus speculum, Hkl.
Autodendrum antarcticum, n. sp.
Auloscena penicillus, Hkl.
Challengeron pearceyi, Hkl.
„ *swirei*, Hkl.
„ *balfouri*, Hkl.
„ *richardsii*, Hkl.

(*B.*) *From the ooze obtained in the trawl.*

The sediment which remains after removing the Diatoms and Foraminifera and larger mineral particles is almost pure Radiolarian ooze of a very peculiar composition. It is distinguished from all other forms of Radiolarian ooze by the fact that it is mainly composed of a few species of Sphæroidea which make up about nine-tenths of the whole mass. By far the commonest of these Spumellaria is *Cromyosphæra antarctica*, which is probably genetically related with the very similar form, *Cromyomma perspicuum*, occurring on the surface at the same station.[1] The characteristic and abundant deep-sea form *Cromyosphæra antarctica* is distinguished from the superficial *Cromyomma*, chiefly by the greater stoutness

[1] See Report on the Radiolaria, pt. i. pp. 85, 262; the figure there referred to, pl. xxx. fig. 8, represents the latter, not the former.

of the bars of its skeleton and the lack of spines on its surface. The diameter of the sphere, which consists of four concentric lattice-shells, varies between 0·15 mm. and 0·3 mm., being usually about 0·2 mm. The two inner (medullary) shells are connected with the two outer (cortical) shells by triangular bars, which have a slight spiral twist. The whole structure is very similar to that which Haeckel has figured[1] in the case of the cosmopolitan *Rhizosphæra trigonacantha*, but it is distinguished from this by the lack of external radial spines and the peculiar structure of the cortical shell, which consists of two strong clearly separated lattice-plates united by numerous radial bars; these latter are often connected together so that the cortical shell becomes spongy, whence this variety might be known as *Spongodictyum antarcticum*. Furthermore, *Cromyosphæra antarctica* appears to be connected by transitional forms with several other species in the accompanying list, as, for example, with *Spongoplegma antarcticum*.

Of the other Spumellaria the Discoidea are the most abundant, particularly the spongy forms (Spongodiscida, *e.g.*, *Spongodiscus*, *Spongotrochus*, *Stylotrochus*). Particularly noteworthy is a new genus, *Spongopyle*, not described in the Report; it is a Spongodiscid with a marginal osculum like that of the Porodiscid *Ommatodiscus*, which also occurs at this Station.

In contrast to the large number of Sphæroidea and Discoidea the Prunoidea and Larcoidea are present only as isolated specimens.

Very few species of Nassellaria are present, but among them the Botryodea, which are generally rare, are rather abundant, especially *Botryocello borealis* and *Botryopyle cribrosa*.

The most common Cyrtoidea are a few cosmopolitan forms, for example, *Cornutella clathrata*, *Cornutella annulata*, and *Lithomitra lineata*.

The Acantharia are only represented in the deposit from Station 157 by a single rare species, *Pantopelta icosaspis*.

The Phæodaria are represented in this deposit by a few remarkable forms, such as *Sagenoscena penicillata*, *Aulosphæra bisternaria*, *Cannosphæra antarctica* and *Conchasma hippurites*; all these, however, are rare.

List of Species from the Deposit.[2]

I. Spumellaria.

a. Sphæroidea.

Cenosphæra solida, Hkl.
„ *papillata*, Hkl.
„ *antiqua*, Hkl.
„ *antarctica*, n. sp.
Carposphæra nobilis, Ehrenbrg.
Thecosphæra diplococcus, Hkl.
Cromyosphæra antarctica, Hkl.
Styptosphæra spongiacea, Hkl.
Spongoplegma antarcticum, Hkl.
Spongodictyon antarcticum, n. sp.
Amphisphæra neptunus, Hkl.
Stauracontium antarcticum, Hkl.
Hexaconium thexaconium, Hkl.
„ *antarcticum*, Hkl.
Acanthosphæra antarctica, Hkl.
Sphæropyle weissenbornii, Dreyer.
Prunopyle antarctica, Dreyer.
Cladococcus antarcticus, Hkl.
„ *dendrites*, Hkl.
Haliomma antarcticum, Hkl.
Actinomma pachycapsa, Hkl.

[1] Monogr. d. Radiol., 1862, Taf. xxv. figs. 1-7.

[2] I am obliged to Dr. F. Dreyer for preparing this list of Radiolarians.

Pityomma piniferum, Hkl.
Cromyomma perspicum, Hkl.
Rhizosphæra trigonacantha, Hkl.
„ *antarctica*, n. sp.

b. Prunoidea.

Cromyocarpus quadrifarius, Hkl.
Cromyatractus tetraphractus, Hkl.
Spongurus cylindricus, Hkl.
Spongocore cincta, Hkl.

c. Discoidea.

Porodiscus flustrella, Hkl.
„ *heterocyclus*, Hkl.
„ *spiralis*, (Ehrenb.)
Ommatodiscus stöhrii, Hkl.
„ *lævigatus*, Stöhr.
Stylodictya multispina, Hkl.
Rhopalastrum irregulare, Hkl.
Euchitonia muelleri, Hkl.
Spongodiscus resurgens, Ehrenb.
„ *spiralis*, Hkl.
Spongopyle osculosa, Dreyer.
Spongopyle setosa, Dreyer.
Stylotrochus antarcticus, n. sp.,
„ *challengeri*, n. sp.
Spongotrochus murrayi, n. sp.
„ *wyvillei*, n. sp.
„ *moseleyi*, n. sp.
„ *willemoesii*, n. sp.
„ *scutella*, Hkl.
„ *antarcticus*, Dreyer.

d. Larcoidea.

Stypolarcus spongiosus, Hkl.
Larcospira oliva, Hkl.

II. Acantharia.

Pantopelta icosaspis, Hkl.

III. Nassellaria.

a. Plectoidea.

Hexaplagia antarctica, Hkl.

b. Spyroidea.

Tripospyris eucolpos, Hkl.
Dictyospyris tetrastoma, Ehrenb.
„ *enneastoma*, Hkl.

c. Botryodea.

Androspyris aptenodytes, Hkl.
Botryocella borealis (Erhenb.)
Botryopyle cribrosa (Ehrenb.)
Botryocyrtis quinaria, Ehrenb.
Botryocampe inflata, Ehrenb.

d. Cyrtoidea.

Cyrtocalpis ovulum, Hkl.
Cornutella clathrata, Ehrenb.
„ *annulata*, Ehrenb.
Cornutanna orthoconus, Hkl.
Halicapsa hystrix, Hkl.
Dictyocephalus antarcticus, n. sp.
Dicolocapsa megacephala, Hkl.
Dictyophimus antarcticus n. sp.
Thercorys plutonis, n. sp.
Lithostrobus bicornis, n. sp.
Theocalyptra cornuta (Ehrenb.)
Lithostrobus cornutella, Bütschli.
Lithomitra lineata (Ehrenb.)
Eucyrtidium chrysalidium, Hkl.

IV. Phæodaria.

Aulactinium actinosphærium, Hkl.
Sagenoscena penicillata, Hkl.
Aulosphæra bisternaria, Hkl.
Aulastrum dichoceros, Hkl.
Aulodictyum hydrodictyum, Hkl.
Cannosphæra antarctica, Hkl.
Challengeria naresii, Hkl.
„ *trifida*, Hkl.
Conchasma hippurites, n. sp.

The Animals obtained in the Trawl.

In addition to the Protozoa, the following is a list of the living animals obtained in the trawl, most of which may be regarded as having been captured at or near the bottom of the ocean. Some of the species are represented by six or eight specimens, and of the remainder one to four specimens were obtained, so that altogether nearly one hundred and fifty individuals belonging to these higher orders were procured by the trawl on this occasion. When we remember that the trawl was only dragged over the bottom for a very short distance, and that the length of the beam was only 12 feet, we can form some idea of the abundance

of life existing in this region at a depth of two and a half miles. It will be observed that nearly all these animals are new to science, those with n. sp. after them being described for the first time in the *Challenger* Reports; many of the species were again found in other localities. The study of this station alone shows what large contributions the *Challenger* Expedition has made to our knowledge of the conditions of the deep sea, the geographical and bathymetrical distribution of life, and the general physics of the globe.[1]

Hexactinellida (Schulze, Zool. vol. xxi. pt. 53).
Balanella pipetta, n. g., n. sp.
Holascus polejaevii, n. g., n. sp.

Monaxonida (Ridley and Dendy, Zool. vol. xx. pt. 50).
Cladorhiza moruliformis, n. sp.

Pennatulida (Kölliker, Zool. vol. i. pt. 2).
Umbellula carpenteri, n. sp.

Actiniaria (Hertwig, Zool. vol. vi. pt. 16).
Cereus spinosus, n. sp.
Corallimorphus objectus, n. g., n. sp.

Madreporaria (Moseley, Zool. vol. ii. pt. 7).
Bathyactis symmetrica, n. g., n. sp.
Leptopenus discus, n. g., n. sp.

Hydroida.
Stephanoscyphus simplex, Allman, MS.

Medusæ (Haeckel, Zool. vol. iv. pt. 12).
Atolla wyvillei, n. sp.

Asteroidea (Sladen, Zool. vol. xxx. pt. 51).
Hymenaster latebrosus, n. sp.
Lonchotaster forcipifer, n. sp.
Hyphalaster planus, n. g., n. sp.

Ophiuroidea (Lyman, Zool. vol. v. pt. 14).
Ophiacantha cosmica, n. sp.
Ophiocten amitinum, n. sp.
Ophiocymbium cavernosum, n. g., n. sp.
Ophioglypha fraterna, n. sp.
„ *lienosa*, n. sp.
„ *loveni*, n. sp.

Echinoidea (Agassiz, Zool. vol. iii. pt. 9).
Pourtalesia carinata, n. sp.
„ *ceratopyga*, n. sp.
Spatangocystis challengeri, n. sp.
Genicopatagus affinis, n. sp.

Holothurioidea (Théel, Zool. vol. iv. pt. 13; vol. xiv. pt. 39).
Benthodytes sordida, n. sp. (13).
Elpidia ambigua, n. sp. (13).
„ *purpurea*, n. sp. (13).
Peniagone horrifer, n. sp. (13)
Oneirophanta mutabilis, n. sp. (13).
Psychropotes longicauda, n. sp. (13).
Psychropotes longicauda, var. *monstrosa*, n. (13).
Psychropotes longicauda, var. *fusco-purpurea*, n. (13).
Scotoplanes globosa, n. sp. (13).
„ *robusta*, n. sp. (13).
Pseudostichopus villosus, n. sp. (39).

Entozoa (Linstow, Zool. vol. xxiii. pt. 71).
Prothelmins profundissima, n. g., n. sp.

Gephyrea (Selenka, Zool. vol. xiii. pt. 36).
Phascolion lutense, n. sp.

Annelida (M'Intosh, Zool. vol. xii. pt. 34).
Lætmonice producta, Grube, var. *wyvillei*, n.
Lætmonice producta, var. *benthaliana*, n.
Maldanella antarctica, n. sp.
Nothria armandi, n. sp. (fragment).
Pista abyssicola, n. sp. (fragment).

[1] In carrying on the work referred to in this paper, I have of course been greatly assisted by the various contributors to the *Challenger* Reports, especially by my colleague, Professor Renard, and by my assistants in the *Challenger* office, Mr. Chumley, Mr. Pearcey, Mr. Ross, and Mr. Dawson.

Praxilla abyssorum, n. sp.
Trophonia wyvillei, n. sp.

Ostracoda (Brady, Zool. vol. i. pt. 3).
? *Bairdia bosquetiana*, Brady.
Macrocypris similis, n. sp.
Cythere dasyderma, n. sp.
„ *dictyon*, n. sp.
Krithe producta, n. sp.
Cytheropteron mucronalatum, n. sp.

Cirripedia (Hoek, Zool. vol. viii. pt. 25).
Scalpellum improvisum, n. sp.

Isopoda (Beddard, Zool. vol. xvii. pt. 48).
Eurycope spinosa, n. sp.

Schizopoda (Sars, Zool. vol. xiii. pt. 37).
Boreomysis scyphops, Sars.
Gnathophausia gigas (Suhm).

Macrura (Zool. vol. xxiv. pt. 52).
Hymenodora mollicutus, n. sp.

Pycnogonida (Hoek, Zool. vol. iii. pt. 10).
Phoxichilidium pilosum, n. sp.

Lamellibranchiata (Smith, Zool. vol. xiii. pt. 35).
Lima (*Limatula*), n. sp. One valve only with the umbo broken away; hardly sufficient to describe.
Leda, n. sp. Probably a young shell.
Lyonsiella papyracea, n. sp.
Neæra meridionalis, n. sp. (fragment).
Silenia sarsii, n. sp.
! *Kellia*, sp. Two valves with damaged apices, making it impossible to determine with certainty its generic position.
—— ? Two very minute shells (mere fry) beyond identification either generically or specifically.

Gasteropoda (Watson, Zool. vol. xv. pt. 42).
Dentalium leptoskeles, n. sp.
Pleurotoma (*Surcula*) *lepta*, n. sp.

Cephalopoda (Hoyle, Zool. vol. xvi. pt. 44).
Eledone rotunda, n. sp.

Polyzoa (Busk, Zool. vol. x. pt. 30; vol. xviii. pt. 50).
Bugula bicornis, n. sp.
Caberea darwinii, Busk (?).
Cellepora bicornis, n. sp.
Idmonea marionensis, Busk (?).
Onchopora sinclairii, Busk.
Salicornaria magnifica, n. sp.

Tunicata (Herdman, Zool. vol. vi. pt. 17).
Abyssascidia vasculosa, n. sp.
Styela sericata, n. sp.

Fishes (Günther, Zool. vol. xxii. pt. 57).
Bathylagus antarcticus, n. g., n. sp.
Macrurus armatus, Hector.
„ *filicauda*, n. sp.
Scopelus antarcticus, n. sp.

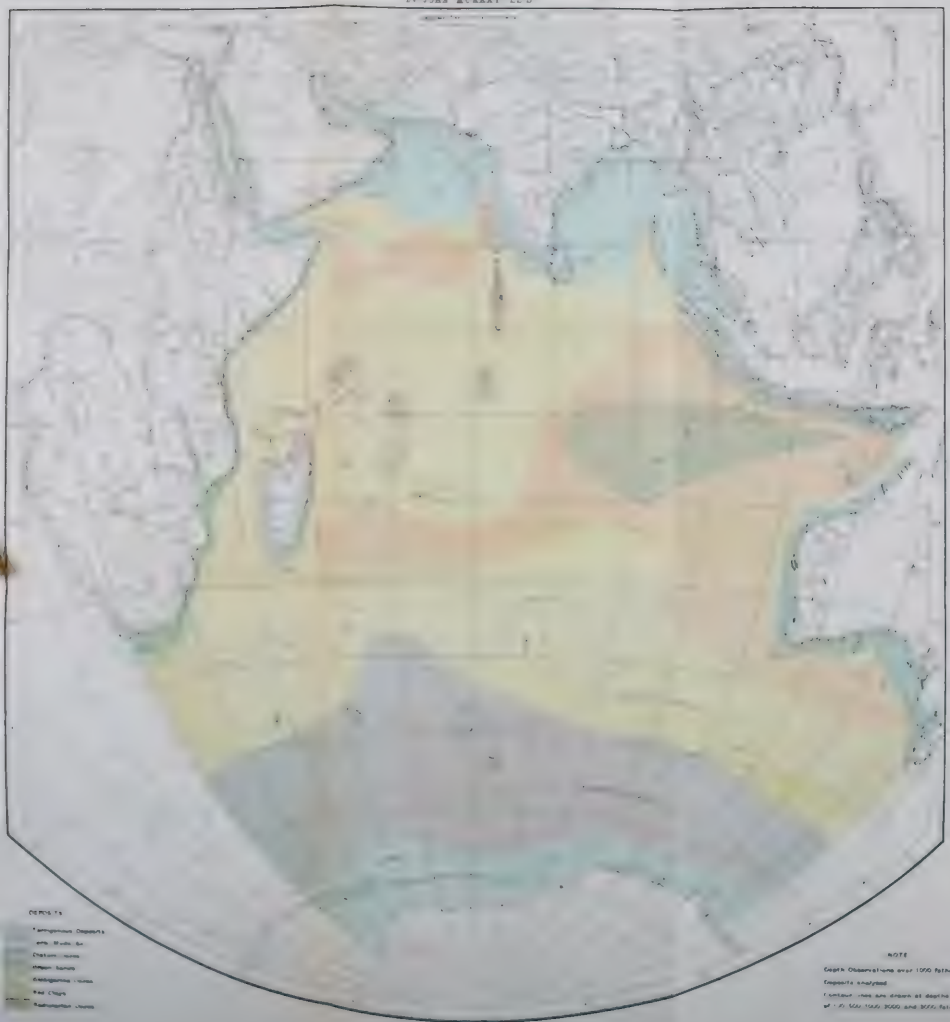
PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

A SPECIAL MEETING of the Society was held on the 1st of July in the Hall of the Merchant Company, Edinburgh, to hear the paper from Dr. Fridtjof Nansen which we publish this month. Dr. Nansen was very cordially received. Professor James Geikie, Vice-President of the Society, was in the chair. Dr. John Murray moved, and Dr. Alexander Buchan seconded, the vote of thanks to Dr. Nansen for his interesting and valuable address.

On the following evening, Dr. Nansen was entertained at Dinner by the Royal Society Club. Dr. Murray presided.

D

INDIAN OCEAN
DISTRIBUTION OF OCEANIC DEPOSITS
By JOHN MURRAY LL.D



DEPOSITS

Terrigenous Deposits
Red Clay
Radiolarian Ooze

NOTE

Depth Observations over 1000 fathoms
Deposits analysed
Contour lines are drawn at depths
of 1000, 2000, 3000 and 4000 fathoms

GEOGRAPHICAL NOTES.

AFRICA.

Congo Railway.—The results of the survey for the proposed Congo Railway, between Matadi and Stanley Pool, have been published in a volume issued from Brussels by the Compagnie du Congo pour le Commerce et l'Industrie, a copy of which, in English, has been received by us. The survey was carried out by fourteen engineers, and is the result of sixteen months' labour. The conclusions drawn are: that it will require a capital of twenty-five millions of francs to lay the line, to purchase the rolling stock, to cover the general expenses in Europe as well as in Africa, and to pay the intercalary interests during the period of laying, estimated at four years. The total length of the line will be 435 kilomètres (270 miles), the first 26 kilomètres (16 miles) of which, it is assumed, alone offer any engineering difficulties. Matadi, the starting-point, is easily reached by sea-going steamers; the terminus at Stanley Pool will be at Ndolo, a short distance above Kinchassa, and, of course, above all the rapids that hinder navigation in the cataract region. Beyond this point light-draught vessels can ascend the Congo and its affluents for an uninterrupted distance of 11,500 kilomètres. Numerous appendices, maps, and statistical tables add to the value of this report. We learn that the first steamer, the *Kinsembo*, of the African Steamship Company, has discharged a cargo at Matadi.

Congo Tributaries.—The great southern tributaries of the Congo have in the past year been explored by the steamer *Roi des Belges*, belonging to the "Compagnie du Congo pour le Commerce et l'Industrie." The steamer left Leopoldville on 27th March, and returned thither after 159 days' absence, having traversed a distance of over 1860 miles. Lake Leopold and the Mfini river were next surveyed. The northern end of the lake has two large bays; on the northern shore of the western bay friendly relations were established with the chief Totay, who resides in Ilambu, a place of some importance.—*Mouv. Géogr.* No. 5, 1889.

West Africa: Kong.—The French traveller, Captain Binger, after a considerable absence, during which he carried out successful explorations in the Mandingo country, has returned to Paris. After being detained in Bonduku, he reached Kong on the 26th December last. He and his companion, M. Treich-Laplène, who joined him on 5th January, induced the ruler of Kong to accept French protection.

Western Equatorial Africa.—M. Crampel has recently carried out a successful exploration of the country behind the Gaboon and the German territory of Cameroons. Leaving Madiville, on the Ogowé, on 12th August 1888, M. Crampel reached the Ivindo, the chief tributary of the Ogowé, of which only the confluence had hitherto been known. He discovered a river flowing west, called the N'Tem, which he regards as the upper course of the Campo. His northernmost point was 2° 15′ N. lat., and here he found traces of Mohammedan influences coming from the north. From the indications given of his route (*Compte Rendu*, page 217, of the Paris Geographical Society), M. Crampel appears not to have reached the water-parting between the Ivindo and Likuala; but his journey has filled up one of the blanks in the map of West Africa.—*Petermann's Mitt.*, vi. 1889.

Mount Milanje.—A correspondent writes to us as follows :—"It may be of interest to you to know that the Rev. R. Cleland made a journey to Milanje, in connection with the extension of the Church of Scotland's East African Mission, during which he ascended the mountain to a height of 7500 feet. Mr. Cleland left his station at Chiradzulo Mountain on December 28th, 1888, and after a march of twenty-five miles, during twenty of which there was no drinkable water, he reached the Tuchira, where he encamped for the night. Between Chiradzulo and Milanje lies a plain, with here and there deep mud formations, and also rocks, in many of which there were large water-worn holes, which, along with other evidence, point, Mr. Cleland says, to the fact that Lake Shirwa once covered all this flat-plain country. The Tuchira, a tributary of the Ruo, takes its rise from some of these mud swamps, abounding in hippopotami, and flows in a south-east direction to join the Ruo. The vegetation of the plain was not so high nor so strong as usual, indicating poorness of soil. From the Tuchira he rose gradually over a distance of eight or nine miles to the base of the mountain. On the 31st he ascended to the flat top, where a very cold night was spent, the discomfort being augmented by rain, which seemed to come with the new year. Next morning an attempt was made to scale the highest peak, which rises like another mountain from the summit plain ; and in order to accomplish this object, Mr. Cleland set off with three men, the rest being unwilling. So rough and toilsome was the way, that after some climbing two of these gave in, then the third, and, lastly, he himself was compelled to come to a standstill by a yawning gorge, of which he had not been made aware. At the highest point he reached, the boiling-point thermometer read 198·2° F., the temperature of the air being 65°F. ; and it is his opinion that 1500 feet added to the resulting height must be very nearly correct as the total height of the mountain. Mr. Cleland reports the table-top to be in appearance like an English farm, with rounded slopes and many streams ; the upper banks (*i.e.* those which are on the same side as the high peak) being precipitous and rocky, but the lower (or south-west) banks are smooth and rounded, while both are covered with dense vegetation. The Ruo rises within a mile of its tributary, the Likabulo, a small ridge of land separating them. The Likabulo valley, Mr. Cleland believes, completely separates Chamba (which is always spoken of as part of Milanje) from Milanje proper. It is also usually considered the highest peak ; but he is of opinion that the one he attempted to ascend will prove higher. The Ruo and the Likabulo present a strong contrast in the mode of their descent to the plain. The former by following the main axis of the mountain (roughly SE.) obtains a gradual gradient ; but the latter reaches the plain at the NW. end by means of a cascade fall of fully 1500 feet, and then it flows SE. to join the Ruo. The water of these and of the other streams observed was of the purest, although it will be noted that the ascent was made during the rainy season. The vegetation is reported as different from that of other observed parts here. Brackens abound ; a coarse species of white heather was frequently seen ; along the banks of the streams tree-ferns are abundant, also fine pine-trees, from the branches of which hung moss a foot long,—the first time pines have been noticed in this part of Africa. As Milanje is the first high mountain which the sea-breezes strike, many parts of it have an abundant rainfall, and in some places you may see green maize all the year round. Many parts at the foot of the mountain being well watered, and having perhaps the best soil in this part of the country, are, Mr. Cleland considers, well adapted for agricultural enterprise ; and by means of the Likabulo and Ruo, water communication with the coast is close at hand. While attempting to climb

the highest peak they came upon traps laid by the Anyasa, and a good distance further down they discovered some of their huts. These people live in small numbers, and have their gardens in almost inaccessible places, for fear of the slaver ; and so great was their terror, that they would not come out of their huts to see him, although repeatedly informed by his men that they brought no war. At one village some of them ventured out, and as it was the first time they had seen a white man, they took him for a spirit. He descended by following the course of the Likabulo, and after a rough walk reached his camping ground. Mr. Cleland hopes later on in the year to revisit Milanje, ascend the highest peak, and investigate the features of the mountain more fully, when we may expect to hear more of this hitherto almost unknown mountain-mass."

AMERICA.

Recent Danish Investigations in Greenland.—The results of recent travel in Greenland are being published in a series of volumes entitled *Meddelelser om Grönland*. Vol. x., by Messrs. Holm and Garde, is devoted to a general geographical and orographical description of the country. According to Holm the coast from C. Farewell to N. lat. 66° is naturally divisible into five zones. The first of these extends from the south extremity to Auarkat 61° 15′ N. lat., and begins with the Kangerdlugsuatsiak or Lindenows Fjord, which runs 35 miles up into the land, and is surrounded with mountains rising to heights of 7300 feet. Under their protection an abundant vegetation is able to thrive. There are almost impenetrable willow groves, and angelicas as high as a man, while the shores are strewn with logs of driftwood sometimes 12 feet in length. This fiord is archæologically interesting from the fact of its containing the only old Scandinavian ruins found on the East Coast.

The second zone extends from Auarkat to Ikermiut in N. lat. 62° 15′, southwards from which there is now no population. The ice of the interior begins in N. lat. 61°, and sends five arms down to the open sea. The Fjord Anoritok was inhabited fifty years ago, and there are still green spots to be seen between the great glaciers which creep down its sides. Inhabitants are now only found within the third zone, which runs from Ikermiut northwards to Igdloluarsuk (N. lat. 63° 32′). The coast here begins to be studded with islands, and the edge of the inland ice-sheet retreats from sight, while the low shores are clothed with an abundant vegetation. The fiords that run inland among mountains 5000 to 6000 feet in height have a beauty and a wild sublimity all their own. At Igdloluarsuk the populated region ends, and the ice-sheet creeps down and discharges its superfluous ice into the sea. Northwards to lat. 66° there are five fiords on the East Coast with glaciers which run into the sea and produce icebergs, viz.—Sermilik, Ikersuak, Pikiutdlek, Igdloluarsuk, and possibly Anoritok. The mountains are of crystalline rock, chiefly gneiss, whose strike on the East Coast is apparently east-south-east, while on the West Coast it has been observed to run at right angles to this direction. The gneiss has been invaded by syenite, and this appears in turn to be penetrated by dykes of brown diabase, while there are also veins of diorite seemingly older than the gneiss. Towards the north a gradual passage of granite into grey hornblendic gneiss with magnetic iron has been observed. In the extreme north hornblendic gneiss predominates. It occurs partly as a very much thrust and contorted schistose mass and partly in alternation with granite, into which it graduates. At Sermilik there is a foliated garnetiferous granitic gneiss with huge pegmatite veins.—*Petermann's Mitteilungen*, 35 *Band*, 1889, V.

Yukon District, N.W.T.—Mr. George M. Dawson's official report on the results of his exploration of the Yukon District and the adjacent northern portions of British Columbia has been published. The expedition, which left Ottawa on 22d April 1887, under the general charge of Mr. Dawson, was undertaken with the chief object of determining the point at which the Yukon or Pelly River crosses the 141st meridian, which there constitutes the boundary between the North-West Territory and Alaska, but it was also successful in obtaining geographical information of the greatest interest. The maps which accompany the report are of original importance. Mr. Dawson thus sums up (p. 10) the main geographical results of the expedition: "Mr. Ogilvy's instrumentally measured line from the head of Lynn Canal to the intersection of the Yukon or Pelly by the 141st meridian, will form a sufficiently accurate base for further surveys. In addition to this we now have an instrumental survey of the Stikine from its mouth to the head of navigation (Telegraph Creek), which is connected with Dease Lake by a carefully paced traverse. This is continued by a detailed running- or track-survey following the lines of the Dease, Upper Liard, and Pelly Rivers, and connecting with Mr. Ogilvy's line at the mouth of the Lewes, the total distance from the mouth of the Stikine to this point by the route travelled being about 944 miles. Adding to this the distance from the mouth of the Lewes back to the coast at the head of Lynn Canal (377 miles), the entire distance travelled by us during the exploration amount to 1322 miles. This, taken in connection with the coast-line between the Stikine and Lynn Canal, circumscribes an area of about 63,200 square miles, the interior of which is still, but for the accounts of a few prospectors and reports of Indians, a *terra incognita*. The same description, with little qualification, applies to the surrounding region outside the surveyed circuit, but much general information concerning the country has been obtained, which will facilitate further explorations. Along the routes thus travelled, numerous points have been carefully fixed in latitude by sextant observations, and a sufficient number of chronometer longitudes have been obtained by which to lay the whole down within small limits of error. Special attention was paid to the sketching and fixing of mountain topography in sight from the line of travel, and the approximate altitudes of a number of peaks were ascertained." The report contains a great deal of detailed original geographical information, and valuable appendices are added. Another useful report dealing with the geography of Alaska has been issued by Mr. Allen, who made a successful journey in 1887. Occasional references to both these expeditions whilst they were in progress have been made in the back volumes of the Magazine.

The Floods in Pennsylvania.—Towards the end of the month of May, long-continued rains in Central and Western Pennsylvania did great damage; but all other loss seems as nothing in comparison with the destruction that fell, in the afternoon of May 31, upon the Conemaugh Valley, in Cambria County. The valley is a narrow gorge, cut by the Conemaugh River through mountains rich in coal and iron and limestone, which supplied the industries of many towns and villages. At the upper end, and at an elevation of about 300 feet above the river, was a body of water formerly known as Conemaugh Lake. This lake, originally a ravine, had been formed by a dam, between 800 and 1000 feet long, built across the lower end. The height and thickness of the dam are not accurately given, but an engineer familiar with it affirms that it was equal to any ordinary pressure. At a level of seven feet below the top of the dam,

the water of the lake covered a surface three miles in length by more than a mile in width. The inflow from the rains raised this level on the 31st May at the rate of ten inches an hour, and at one o'clock P.M., when the engineer walked over it, the top of the dam was three inches below the water, which was beginning to cut a channel for itself. Of what material was the work that yielded so soon? Less than two hours after, the dam gave way and the flood poured down the valley. The three miles of water were drained out, says the engineer, "in forty-five minutes." Warning of the danger had been sent by telegraph early in the day, but there were many whom it did not reach. Everything in the path of the torrent went to ruin. The smaller towns and villages have been annihilated; and the loss of property amounts to many millions. At Johnstown alone, thirteen miles from the lake, the damage done is summed up at not less than $20,000,000. The number of those who perished may never be rightly known; but men begin to believe that the estimate of 8000 may fall short of the truth. No calamity of equal magnitude is recorded in the history of the United States.—*Bulletin of the American Geographical Society*, vol. xxi. No. 2.

The Coxcomb Mountains, in British Honduras, although only twenty-three miles from the coast, have for the first time been reached (April 1888) by Europeans.[1] A party under Governor Goldsworthy started from the small port of Allpines, from whence one detachment ascended the South Stann Creek by canoe, whilst the other made for its upper course by the most direct route. The expedition met with considerable difficulties, as the mountains, far and wide, are covered by dense forests, and are uninhabited. The culminating point of the mountains is the Victoria Peak, 3609 feet.—*Petermann's Mitt.* vi. 1889.

The Tumuc-Humac Mountains (Guiana).—M. Henri Coudreau, who for eight years has been exploring the unknown regions of French Guiana, has recently carried out explorations in the little-known Tumuc-Humac Mountains, an account of which he gave at a meeting of the Paris Geographical Society on 24th May last (*Compte Rendu*, No. 10, 1889). His surveying operations were of the most extensive character. The climate of these high regions is said to be healthy, the mean temperature being about 72° Fahr. The foot of the mountains is covered by an immense belt of forests. M. Coudreau carefully studied the ethnographic characteristics of the score or so of Indian tribes, which, for the most part, lead an industrious and peaceful life there.

Orinoco River.—Count Stradelli has been unable to carry out his original intention of exploring the sources of the Orinoco; he, however, followed the river to San Fernando de Atabapo, the capital of Alta Orinoco, and ascended the Atabapo to Yavita. From Maipures, on the middle course of the Orinoco, he made a short journey in October, 1887, to the Vichada, a western affluent, and Macacha. He makes the Vichada to flow into the Orinoco under one degree of longitude west from Caracas; should this prove to be the case, our maps of the middle course of the Orinoco place it some 25′ too far west.—*Petermann's Mitt.* vi. 1889.

AUSTRALASIA.

British New Guinea: Owen Stanley Range.—In reference to the recent successful exploration of the Owen Stanley Range by Sir W. MacGregor, the Administrator

[1] *Report of the Expedition to the Unexplored Coxcomb Mountains.* By H. E. H. Jerningham. Pp. 31; map. Belize: 1888.

of British New Guinea, we have been favoured by the Colonial Office with the following copy of a telegram, dated 15th July 1889, from the Governor of Queensland to Lord Knutsford, the Colonial Secretary :—"MacGregor returned Port Moresby after most successful exploration crest Owen Stanley Range ; named Mount Victoria, 13,121 feet ; new mountain north of Owen Stanley, 12,500, named Albert Edward ; many other peaks of little lower elevation discovered and named." The punctuation is our own. The Society's interest in New Guinea exploration was so markedly shown in the equipment of Mr. H. O. Forbes's expedition, that the news of Sir W. MacGregor's success, details of which have been kindly promised us by the Colonial Office, will be received by members with the highest gratification.

GENERAL.

Dr. A. Penck, of Vienna, in a letter to the editor of *Petermann's Mitteilungen* (35 Band, 1889, No. i.), offers some criticisms on **Dr. Murray's** paper, published in the Magazine (January 1888), "**On the Heights of the Land and the Depths of the Sea.**" Murray's estimates, he says, of the areas of the separate divisions of the earth and of the sea, differ throughout from the estimates arrived at by H. Wagner, Eurasia appearing about 1 per cent. larger, Africa about 2 per cent. smaller, and the surface of the land 2½ per cent. less, if the Antarctic be left out of account. The surface of the sea also is with Murray considerably smaller than with Wagner. Murray indeed estimates the Antarctic continent at 9,064,000 square kilomètres, while Wagner leaves it out of account, and assigns to water the whole of the south Polar region, but the difference of the superficial area in the two authorities amounts nevertheless not to 9 but to 12 millions of square kilomètres ; since Murray finds for the whole superficial area 497,542,300 instead of 509,950,714 square kilomètres. The latter number, it is true, holds good only for Bessel's spheroid, but the difference between this and the other corresponding spheroids is but trifling. The errors in Murray's numbers amount in the mean to 2½ per cent. of their value. His tables must therefore be used with caution, but they will always be serviceable till replaced with better. [Murray gives (*Scot. Geog. Mag.*, vol. ii. page 550) a calculation showing how he gets the surface of the sphere : until Penck produces figures more nearly approximating to the truth, his criticism can in no way be accepted. He must also show that this calculated surface of the sphere is nearer the truth than the calculated surfaces of land and sea from the planimeter observations on equal surface projection maps as given in Murray's paper.] Murray, in using the superficial areas of the land and the sea as a basis for estimating the bulk of the land and the volume of the ocean, avails himself of a procedure which has already been described by Heiderich, and which is by no means free from arbitrariness in its application. He under-estimates the bulk of the land at the different gradations of height, and at the same time over-estimates the volume of the ocean. An idea of the configuration of the land-bulks as he estimates them would be furnished by a model of the land shown as ascending in the form of a staircase, in which each gradation of height laid down would be represented by a projecting ledge—[This is incorrect. Penck has misunderstood the method of calculating the quoit-like segments]—and in like manner his sea-volumes would appear as step-formed depressions in which each gradation of depth has its projecting corner. [Here Dr. Supan, the editor, shows in a footnote how this objection does not hold good.] His mean heights of the land are therefore smaller, and his mean depths of the sea greater than they would be

reckoned if the land were represented with a continuous upward slope and the sea with a continuous downward slope.

Dr. Penck then shows in a table how his own estimates of the mean heights of the different continents differ from Dr. Murray's estimates :—

	Europe.	Asia.	Africa.	Australia.	N. America.	S. America.
Murray,	286 m.	972 m.	616 m.	245 m.	575 m.	633 m.
Penck,	280 m.	950 m.	650 m.	280 m.	600 m.	630 m.

Then follow tables in which the feet and fathoms in Murray's summary tables are converted into their corresponding values in mètres.

The editor, Dr. Supan, who states that he has himself examined Dr. Murray s estimates of heights, partly with a view of comparing them with those of Lapparent, follows up the letter with some remarks of his own. He has discovered, he says, in Murray's reckoning of the mean heights of South America, an error which essentially modifies the final result, but he does not specify what this error is. In the following table he shows how Lapparent's estimates of the mean heights of the different continents differ from those of Murray :—

	Lapparent.	Murray-Supan.
Europe,	290 mètres	290 mètres.
Asia,	880 „	940 „
Africa,	610 „	620 „
Australia,	360 „	260 „ (300)
N. America,	600 „	610 „
S. America,	540 „	610 „

In the case of Australia a full comparison of the two estimates cannot be instituted, since in Murray's tables New Guinea and Polynesia are united with the Sunda Islands. If these islands, which are usually assigned to Australia, be excluded, the mean height for Australia is 260 mètres, otherwise it is 300.

Dr. Supan undertook also a new calculation of the mean depth of the contents of the sea, in making which he had in one point to alter Murray's method. Murray, he says, in order to take into account the effect of erosion, estimates the mean height of the slope between two contour lines of land as $\frac{1}{3}$ of the hypsometrical distance between them and for the sea from $\frac{1}{2}$ to $\frac{2}{3}$. The latter assumption seems to him to be incorrect, and he has in all cases employed $\frac{1}{2}$ in his calculations. The agreement of his numbers with those of Penck shows, he says, that his assumption comes nearer the truth :—

	Atlantic Ocean.	Pacific Ocean.	Indian Ocean.
Penck,	3290 mètres.	3870 mètres.	3590 mètres.
Murray-Supan,	3330 „	3870 „	3600 „

In both these tables the Arctic Sea is taken along with the Atlantic Ocean, and the seas near shore with their respective oceans. In the following tables he gives the estimates made by different authorities of the mean height of the land and the mean depth of the sea :—

	Land.	Sea.
Humboldt,	310 mètres,	...
Krümmel,	...	3320 mètres.
Lapparent,	650 „	4260 „
Murray,	686 „	3800 „
Murray-Supan,	680 „	3650 „
Penck,	705 „	3650 „

In the 3650 mètres the Antarctic Ocean as unknown is left out of the account. In the open ocean the mean depth is 3950 mètres ; in the seas near shore 1100 mètres.

A Bathymetrical Chart of the Indian Ocean is published in the current number of *Petermann's Mitteilungen* (vii. : 1889), which will be interesting to compare with the map we publish this month. Dr. Supan, the editor of this invaluable periodical, in a note on the subject, remarks that, eight years ago, Professor Krummel published a similar chart in vol. ii. of the *Zeitschrift für wissenschaftliche Geographie*, which only in the outlying regions had any claim for accuracy ; while the greater part of the interior basin contained nothing but the words, "no soundings." This unknown ocean area, in which up to 1880 only the *Gazelle* had undertaken any considerable number of soundings, has since then been frequently crossed by scientific expeditions. They are now in a position to construct a map which, indicating every thousand mètre line, at least gives the general configuration of the sea-bottom. Only the main features can of course be given, because the soundings are far apart, and several blank spaces are encountered. One of these general features may, however, be accepted with some confidence : the basin of the Indian Ocean has in the east its greatest and most extensive depression, which stretches in the form of a tongue off the south coast of Australia. The Indian Ocean thus contrasts with the Atlantic and Pacific Oceans, in which the greatest depths are more to the west. The expeditions referred to are the following:—(1) *Enterprise*, Captain A. S. Barker, 1st June to 6th September 1883 ; (2) *Essex*, Captain T. F. Jewell, 20th November to 13th December 1886 ; (3) *Flying Fish*, 7th December 1886 to 22d March 1887 ; (4) *Egeria*, Captain Pelham Aldrich, 1887. The results of the last expedition, the most important of all, are given in *Petermann's Mitteilungen* (vii. : 1889) and in *Annalen der Hydrographie* (p. 339 ; 1888), to which reference may be made. In the course of his concluding remarks, Dr. Supan points out that, regarded as a whole, the temperature conditions in the South Indian Ocean are very similar to those found to obtain in the South Pacific Ocean, both being connected with the Antarctic Ocean. We ourselves published in the Magazine (vol. iii. p. 566) as far back as 1887, a "Map of the Indian Ocean, showing depth of water and height of surrounding land," to illustrate the paper by Dr. Murray, referred to on page 406 of the present number. This map, though the contour-lines give the soundings at 100, 500, 1000, 2000, 3000 fathoms, seems to agree so far with that of *Petermann's Mitteilungen*, though, by missing out the 2500 fathom-line, the remarkable depression in the east of the Indian Ocean is not so strongly marked.

Surface Currents of the North Atlantic Ocean.—Prince Albert de Monaco, to whose interesting experiments on board the *Hirondelle* we have occasionally referred, has made another communication (3d June) to the Paris Geographical Society. Of the 1675 floats that were thrown overboard at various spots, 146 have been recovered, seven of which, not having an authentic record of their history, were useless. The experiments appear to bear out the circular movement of the surface waters round a central point situated somewhere to the south-west of the Azores, and to confirm what has hitherto been accepted as the course of the Gulf Stream.

MISCELLANEOUS.

An **Anti-Slavery Congress** will assemble at Lucerne between the third and tenth of August.

A useful paper on the **Eskimo Race and Language**, by A. F. Chamberlain, is published in *Proc. of the Canadian Institute*, April 1889.

The German **Geographentag** was held in Berlin from 24th to 26th April last. These meetings are in future to be held every alternate year.

Dr. Hans Meyer, in spite of his misfortunes, is about to undertake another expedition into Eastern Equatorial Africa. His goal this time is to be Mount Kenia, and possibly Mount Kilima-njaro.

Professor Schweinfurth concluded his work in Southern Arabia last April. As the object of his expedition was exclusively botanical, he found little time for topographical work.

Mr. J. Y. Buchanan, F.R.S., has been appointed Lecturer in Geography to the University of **Cambridge**, in succession to Dr. Guillemard, who, through ill-health, was obliged to resign the office.

The volcano of **Vulcano**, in the Lipari Islands, has been in a state of eruption for the last twelve months, and shows no sign of abatement. The island is reported to be completely ruined and almost deserted.

The town of Karakol, where General **Przhevalski** died, has, by a decree of the Tsar, been re-named after the great explorer. The monument to be erected there to his memory is to be surrounded by an open park.

We regret to notice the death, at Sydney, of **Sir Edward Strickland, K.C.B.**, the President of the Royal Geographical Society of Australasia. Sir Edward was Commissary-General in the British Army, and served in the Crimean War.

The *Mouvement Géographique* for 14th July announces that the long expected **Conference on African Affairs** is to be held in Brussels in October or November next, and that the subjects to be discussed are the Slave-trade, and the means employed in the introduction of European civilisation into the heart of the continent.

Mr. R. Bruce Foote has visited **Rameswaram Island**, situated between India and Ceylon, for the purpose of studying the coral formations there presented. The first part of an account of his researches appears in the May number of the *Madras Christian College Magazine*. We hope to note in a future number some of the results of his investigations.

It is reported from Copenhagen that an expedition consisting of seven men under an officer of the Royal Danish Navy, provisioned for two and a half years, will leave next Spring on board a whaler for the East Coast of **Greenland**, which it is proposed to explore between latitudes 66° (Holm's furthest) and 73°. Dr. Nansen, also, hopes to repeat his feat of crossing Greenland from east to west, and at a much higher latitude.

The Imperial **British East Africa** Company's agent at Mombassa reports the safe return of the expedition sent in March last under Mr. J. R. W. Pigott to the Galla Country. Treaties have been concluded on behalf of the Company with the various chiefs of the territories lying between the rivers Tana and Jub, and a station has been established on the north bank of the Tana at Otto Borurova, in the Korokoro district, in lat. 0° 40′ S., and long. 39° E.

NEW BOOKS.

L'empire d'Annam et le peuple Annamite, aperçu sur la Géographie, les productions, l'industrie, les mœurs et les coutumes de l'Annam. Publié sous les auspices de l'Administration des colonies. Annoté et mis à jour par J. Silvestre, Administrateur principal en Cochinchine, etc. Avec une carte de l'Annam, hors texte. Paris: Librairie Félix Alcan. 1889. Pp. 380.

The first half of this book consists of a reprint of an anonymous work which the authorities at Saïgon considered worth publishing in 1875-6 in the official journal. It appears to have been the work of French missionaries, and contained, no doubt, all the information available at the time it was composed. But none of it is less than thirty years old, while some of it is more than forty. Obviously, therefore, much of the information must be defective or inaccurate, and the latter half of the book is intended to correct this, and bring the work generally up to date. As regards geographical descriptions, notes on the resources of the country, and the like, the wisdom of this plan may be questioned. Both sections of the work, however, contain a good deal of interesting matter relating to the people, their beliefs, customs, and general culture, their occupations, industries, etc., and the history, somewhat in detail, of the gradual spread southward of the Annamite power, and its relations with the Chinese. Coming down to recent events, we gather from this work a confirmation of what we have read elsewhere of the social disorganisation and consequent general suffering—temporary, we may hope—resulting from the late French conquests. The chapter in the second part of the work on the course of the Mekong is by no means exhaustive. It may be doubted how far (as is here asserted) Garnier was dependent on Klaproth for his mapping of the upper course of the river. Lavallée and Desgodins both describe this with sufficient accuracy when they say that it is hemmed in between the valleys of the Kin-sha-Kiang (upper Yang-tse) and the Salween. On looking at the map which accompanies the volume we were at a loss, at first, to comprehend why it should be there. It is an old map, date 1838, by Mgr. Taberd, and published originally in Calcutta. Naturally it is full of mistakes; *e.g.* the great lake Tonle Sap is placed about a degree too far east, and the Siamese frontier, instead of running eastwards from the lake, across the Mekong valley, to the range of hills which runs parallel with the coast at some sixty to one hundred miles distance, is made to run directly north (or a little W. of N.) from the lake. But referring to M. Silvestre's introduction, it is precisely in this gross error that the value of the map consists, viz., to give his own words: "parce qu'elle constitue un document que la France et l'Annam pourraient avoir à faire valoir, le jour où l'on aurait à régler des différends susceptibles de s'élever, relativement à certaines provinces de la vallée du Mé-Kong. C'est un titre à conserver soigneusement." Assuming this to be a provision for a future "rectification" of the Franco-Siamese frontier, it is amusing enough. As to its authority, perhaps we need only refer to a work which for all French geographers and politicians must effectually supersede the old bishop's, viz., the map accompanying Garnier's great work, of which a new edition appeared in 1885, and which in all essentials gives the frontier with substantial accuracy. It is traced carefully according to the best authorities in the map accompanying Mr. Coutts Trotter's article on "Siam" in the *Encyclopædia Britannica*. The author speaks of the name "Cham," applied to the scattered tribes, probably of Malay, or other sea-ward origin, on the coasts of Annam, as being connected with the now nearly obsolete

name of Champa (Ciampa), as if this=Cham-pa. But the name Champa, like many others in Indo-China (Ayuthia, Camboja, etc.), is probably of Indian origin (see Yule's *Marco Polo*).

Christianity, Islam, and the Negro Race. By Edward W. Blyden, LL.D. Second Edition. London: W. B. Whittingham and Co., 1888. Pp. 432.

We have received from the publishers the second edition of Dr. Blyden's collection of papers on the above subjects. In its way it is an unique work, and should be carefully read not only by the student of African politics, but by all who, having the true interests of Africa at heart, are in a position to exert any influence on the destiny of that great continent. In brief, it is a work of the highest importance, especially at the present time, when Africa is experiencing probably the most critical phase in her long and eventful history. For within the present century will undoubtedly be laid the foundation of her future greatness. By what methods is that continent to be awakened from her long sleep, and reclaimed as a heritage of humanity? By whose efforts is it to be developed: by those of the European or by those of the African? Which shall be the dominant religion: Islam or Christianity? Shall freedom or slavery be the lot of those savage tribes which people its almost impenetrable interior, and know not the true God? Shall Europe stand by and see her brethren, though they be "heathen," sink under the fetters of barbarism? Such questions as these are being asked daily, the more persistently as the continent becomes known and opened up to European influence. The senseless scramble for territory, the shameless introduction of the worst products of civilisation, gin and gunpowder, have exerted their evil influences on the development of a rational and concerted policy for the exploitation of Africa; and now the nations stand aside, for the most part content with what spoil they have secured—for there is little left to wrangle about; but as yet, unhappily, no effective and concerted action has been proposed by which Africa, with its teeming population, can be brought under the guidance of Europe. When we speak of Africa, we of course exclude the Mediterranean States and the older colonies: it is the remaining portions of the continent which now await the verdict of Europe as regards their future fate. Questions such as these are to be asked at the forthcoming Conference at Brussels, and it is earnestly to be hoped that they will be considered in a spirit of righteousness and justice.

Meantime, there has arisen for Africa a champion she never before possessed; Dr. Blyden, a pure-blooded Negro, a ripe scholar, a Christian and a reformer. Dr. Blyden needs no apology from us; he is known to all who are in any way connected with Africa, and to many others, for his exceptional endowments. A perusal of his volume, which is charmingly written, convinces us of his sound, erudition; whether we agree with him or whether we disagree, we cannot help respecting his sincerity and opinions. Though he has had the advantage of a European training he is at heart a Negro, and is able to think as only a Negro can: his utterances are therefore the more important. It is natural that all his hopes should centre round the Negro Republic of Liberia, in which he has long held high office. The Republic is an experiment, and so far it has justified the hopes of its American founders. Why should not the experiment on an extended scale be repeated in other parts of Africa? The Negro, having shown himself capable of adaptation, elevation, and self-government, is the most fitting companion to work side by side with the European in Africa; being a Negro he can better withstand the climatic dangers; being a Negro he can

better influence his Negro brethren. This is Dr. Blyden's plea. He points to the United States of America, and says: You forcibly deported the sons of Africa to assist in the rough work of building up your States; now that you have done with them, return them to the home of their ancestors, to which they look as the Jews look to Palestine. Will a Christian State, which can feel the responsibility of a national debt, feel also the responsibility of the greatest national debt it can incur—the infliction of a national injury—without endeavouring to remove it? In truth there is equity in his argument, though he may not have the power to bring it home to his hearers. Dr. Blyden is now on his way to America with the very object of enforcing this appeal. He hopes to persuade some of the States, especially in the South, to assist larger numbers of Negroes to go to Liberia than at present find their way there. Liberia would then become a basis from which the central parts of Africa might be influenced.

That this question—the labour question—is the most pressing for Africa we already have painfully experienced. It is quite natural to infer that the Negro is more suited than the European, or even the Asiatic, to the climate of most parts of Africa. It has been abundantly shown that European communities cannot live for any length of time in the unhealthy regions, especially on the coast. But Dr. Blyden insists too much upon this point; no doubt his West African experience misleads him: there he says, and says with truth, the European becomes enervated and even demoralised. Yet there are wide regions in Africa, in the South, in the East, and on the high plateaux, where Europeans find not only a healthy but a congenial climate. Take away these, and there still remains an immense area of the continent in which the European will never thrive; it is a sufficiently large extent of country. How to obtain native labour is, and will be for years to come, the most embarrassing question for the administrator. Under these circumstances, therefore, the suggestions which Dr. Blyden makes are well deserving attention. The lamentable example of Hayti, though not altogether a parallel case, will undoubtedly prejudice his hearers.

Dr. Blyden discusses a host of other subjects in his book—the methods of Christian missions, Islamism, among others—but into these subjects we cannot follow him. We cordially welcome his book as a valuable contribution to the bibliography of Africa, and trust it will be read by those who are sufficiently brave to look at more than one side of a question.

A Visit to Stanley's Rear-Guard at Major Barttelot's Camp on the Aruwhimi; with an Account of River-life on the Congo. By J. R. Werner, Engineer, late in the service of the Etat Indépendant du Congo. Portraits and other Illustrations. Edinburgh and London: William Blackwood and Sons, 1889. Pp. 330; Index. *Price* 16*s*.

A visit which the author paid to Yambuya Camp, on the Aruwimi, which was then held by Major Barttelot and Stanley's rear-guard, is the main apology for this volume. Incidentally, as an officer of the Congo Independent State, whose duty it was to accompany several interesting expeditions as engineer, we have descriptions of river-life on the Congo and of the episodes of travel. The rest of the book is filled up by the author's reflections on several burning questions in African politics.

We may at once say that the book as it stands, though apparently put together somewhat hurriedly, was worth publishing. The geographical information it contains is for the most part already known; in places it supplements our knowledge, and his brief description of the journey up the Ngala, a right-bank

tributary of the Congo, in company with Lieut. Baert, is valuable, for they were the first to ascend this waterway. His description of the Stanley Falls Station, its brave defence by Mr. Deane, and its subsequent fall, will be read with interest by English readers who have not seen Captain Coquilhat's book, *Sur le Haut Congo*. But we venture to think the chief value of Mr. Werner's book is the candid manner in which he speaks of the interior and little-known working of the machinery of the Congo Independent State. We have known other ex-servants of the State to speak in a similar way. Still, Mr. Werner, like many others, does not appear to appreciate the immense difficulties which the State, with its limited appliances and its unlimited responsibilities, has to contend against. He blames the State for not giving greater freedom of action to its officers on the spot, and ascribes this reason for the loss of the Stanley Falls station. That it is maladministration to endeavour to control from Brussels a station so remote as Stanley Falls goes without saying, but we might cite cases nearer home where a similar policy is pursued. The instances which Mr. Werner gives of the imperfect administration of the State are better told than hidden; improvement will only come when the truth is known.

There is another matter on which Mr. Werner speaks fearlessly, and, we think, advisedly. It is, to put it mildly, the fundamental incapacity of Tippu-Tib to act as a high officer of the Congo State. We can appreciate the diplomatic measure of appointing him Governor of the Falls Station, but though it served a temporary purpose, in spite of his *mala fides*, it would be an impossibility to retain him in office: some day, in the nature of things, the "Bismarck of Central Africa" must rule supreme over his slave preserves or fall before the advance of Western ideas. Many, however, of Mr. Werner's strictures are weakened by a chauvinism which does more credit to his heart than to his mind; for instance, he speaks of Mohammedanism as "a religion of carnage, sensuality, and lust" (p. 312).

Mr. Werner's narrative is interesting throughout, and it is well written. He seems to have had more than his share of adventures and fights with the natives. His book, especially at the present time, is sure to command attention. The illustrations and the map are excellent.

From My Verandah in New Guinea. Sketches and Traditions. By Hugh Hastings Romilly, C.M.G., Deputy Commissioner for the Western Pacific. With an Introduction by Andrew Lang, M.A. With Map, pp. xxvi.+277. London: David Nutt, 1889. *Price* 7*s.* 6*d.*

This volume forms a welcome supplement to the author's book on *The Western Pacific*. It throws much interesting light on the character of the natives, the fruit not merely of intimate acquaintance, but of close observation combined with a knowledge of what is worth observing and recording. From what he tells us of their peculiar superstitions and habits of thought, we no longer wonder at the numerous collisions with white people, caused often by no fault on either side, or at most by excusable ignorance of native ideas. With increased knowledge on both sides, matters must improve, especially under the careful and sympathetic supervision of our officials. For "adventurers," from Drake downwards, are not all ruffians; Mr. Romilly asserts that the modern representatives of this class, diggers and prospectors, are singularly amenable to reason and order, and indeed make and enforce stringent laws for their own benefit.

New Guinea for the most part has escaped the evils of the Labour Trade,

but some very brutal and disgraceful acts of kidnapping and wholesale murder were committed by vessels trading to Queensland, the result of which was that the kidnapped labourers, or at all events the survivors, were restored to their homes under Mr. Romilly's charge: all that he writes on this subject is therefore well worth attention.

Head-hunting, cannibalism, and various native ways and habits are discussed in a manner equally humorous and incisive. If there is no material addition to our geographical knowledge in a narrow sense of the word, we learn something of the character both of the coasts and of the interior in the accounts of expeditions undertaken for sport or business.

A considerable part of the volume is occupied by some curious native stories and traditions, of which the author has a large collection, most of them unfortunately needing to be much "Bowdlerised" to fit them for publication. Mr. Andrew Lang's comments on these stories, in which he finds the elements not only of mythology but of poetry, and which certainly contain conceptions with which we should hardly have credited the Papuan, will be read with interest.

A Naturalist's Voyage round the World. By CHARLES DARWIN, M.A., F.R.S. London: John Murray, 1889. Pp. 519. *Price* 3*s.* 6*d.*

The re-issue of the famous voyage of the *Beagle* at the popular price of 3s. 6d. cannot fail to be appreciated by the public at large. To readers of the feebly written impressionist records of untrained tourists who find their way round the globe by hundreds every year, the journal of the *Beagle* and the keen observations of her naturalist half-a-century ago open up a world that is new and refreshing. It is a book that cannot grow old, and it is one of the very few which are equally interesting to the scientific student and the general reader.

Kaleidoscope: Shifting Scenes from East to West. By E. KATHARINE BATES. London: Ward and Downey, 1889. Pp. 275. *Price* 12*s.*

This is a readable account of a voyage round the world *via* Tasmania, Australia, New Zealand, China, Japan, Alaska, and Canada. The authoress is difficult to please. She notes the "strife of feminine tongues" on board ship, and envies the men who escape to the smoking room, whilst at Hobart she is surprised at the arguments, "more ingenious than fair," used by Bishop Sandford in the course of his sermon. She considers Australia "most uninteresting; a second or third-rate England, with the substitution of a 'climate' for our own fogs and bitter winds. It has all the 'bumptiousness' and self-assertion of America without her originality; all the energy for money-grubbing without her enthusiastic ambition to possess what is noblest in art and literature when the money is made."

When the authoress, however, reaches Alaska, the character of her comments changes. At Glacier Bay she exclaims, "What marvels met our delighted eyes! I think this one spot repays one for the whole expedition, and puts to flight once and for ever any comparison with Norway, Switzerland, or any other part of the snow-clad regions which I have ever visited. Walls or cliffs of ice 320 feet sheer down to the water, and of every exquisite shade of deep and faint green and blue, face one as the bay is entered. The Muir Glacier (which we ascended later) seemed quite close upon us for miles before we came to anchor." The icy walls of the Muir Glacier "are more than twice the height of Niagara, and with the brilliant sun shining full upon them, the effect was like fairyland." It is

the "Trip to Alaska" that distinguishes this voyage round the world from most books of the kind and furnishes a new and attractive goal for travellers,—a goal, we may add, easily reached by steamers from Victoria, Vancouver Island, although, says our authoress, "the accommodation on board the Alaska steamers leaves a great deal to be desired."

The History of a Slave. By H. H. Johnston, F.R.G.S., F.Z.S., etc. London: Kegan Paul, Trench and Co., 1889. *Price* 6*s.*

Our present Consul at Mozambique, whose paper on Masai-land and Kilimanjaro when read to the Society first revealed the attractions of the land now under the Imperial British East Africa Company, has here skilfully pieced together, in a realistic autobiography of a slave, his unique experiences of the worst scenes of African life when he was at Old Calabar. He tries to tell the horrors of slavery and the slave-trade, apart from the treatment of women about which decency compels silence. But even he has nowhere in this volume, horribly attractive as it is, told anything quite so bad as the last published letters from Mr. Bain and Dr. Kerr Cross in Nyasaland revealed. The locality of most of Mr. Johnston's incidents is the Western Sudan, the Niger delta, and Cross River, and the people chiefly described are the Mbudikum. The volume has a special art and science value, because of its 47 full-page illustrations, engraved *facsimile* from the author's drawings. Add to the story some such accounts of the efforts of Christian missionaries to prevent, relieve, or abolish the slave-trade, as we are familiar with from the lives of Livingstone and his successors to Laws and Farler, and the book will be complete.

David Livingstone. By Thomas Hughes. "English Men of Action Series." London: Macmillan and Co. With Portrait and Map. Pp. 208. *Price* 2*s.* 6*d.*

This is a compilation from Livingstone's published works and the *Personal Life* by Dr. Blaikie (Murray, 1880), and gives a fair outline of the great traveller's work; but there is nothing new in the book, and it is not so complete as the *Personal Life*, from which it seems largely drawn.

The map is by Stanford, but somewhat out of date. It is that prepared for Dr. Blaikie's *Personal Life*, and without any attempt at bringing the geography of Southern Central Africa up to date. early ten years have passed since the map was compiled, and much has been added since then to our geographical knowledge of the Lakes District and of the sources and affluents of the Congo. We must confess some surprise at this omission. A few missionary stations have been added; but this does not make up for the wants of a map purporting to be a new one, since we see no mention anywhere of its having done duty previously.

The Trade of the United Kingdom with the World. By T. J. Dymes, B.A. Pp. viii. + 116. London: Elliot Stock, 1889. *Price* 3*s.* 6*d.*

The compiler of this valuable *résumé* of the Board of Trade Returns has done his work well, and produced a brief and clear summary of the chief facts with regard to British Trade. Chapters I. to IV. run over the principal imports of the United Kingdom, and show in tabular form the countries from which each product comes, and the amount received. Chapters V. and VI. treat

of the exports from the United Kingdom in the same way, giving a good idea of the value of the different countries of the world as markets for each kind of British produce and manufacture. The remainder of the book gives tables of the total British trade in imports and exports with the other countries of the world.

Being founded on the Board of Trade Returns the statistics are official and trustworthy ; and the compiler very wisely departs from the over-accuracy of these returns, and expresses all his figures in round numbers. The little volume should be of great use to teachers and students of Commercial Geography as a compendium of one aspect of that study. The preface states that "A great portion of the book, such as particularly Chapters I., VII., and IX., was written expressly for the rising generations of commercial students, and, it is trusted, will enable them to meet the examinations in this branch which now await them. . . ." An attentive study of the book would certainly enable a student to meet those parts of an examination which relate to the United Kingdom and its trade ; but such a very one-sided view of German or French commerce as is presented by a statement of the trade with the United Kingdom only could never satisfy any examiner.

Statistisk Aarbog for Kongeriget Norge. Ottende Aargang, 1888. Udgivet af del Statistiske Central-Bureau. Kristiania, i Kommission hos H. Aschehoug & Co., 1888. Pp. 126.

The yearly report of the kingdom of Norway, a bilingual production in Norwegian and French, again lies before us. The present volume contains very useful information about the area, population, crime, poor relief, education, real property, fisheries, commerce and shipping, communication, banks, and insurance. The census figures for the population are those for 1875 ; but on p. 14 will be found the record of the number of inhabitants in the principal *towns* of the kingdom, according to the communal counting of 31st December 1885.

B. Bradshaw's Dictionary of Mineral Waters, Climatic Health Resorts, Sea Baths, and Hydropathic Establishments. With a large map and several smaller maps and plans. London : Trübner and Co., 1889. *Price* 2*s.* 6*d.*

This is a work of considerable value, and one which has not failed to be appreciated, as it has appeared in new editions from time to time. This, the latest edition, attempts to give the most recent information concerning the numerous places with which it deals. It appears to be trustworthy in the details given, with some few exceptions.

After some advice to bathers, and a few hints to visitors at watering-places, there follows a list of diseases and of the places where they can be most effectually treated. Then there is a table showing the quickest routes, the modes of conveyance, etc. A classification of mineral waters follows, and at this point begins the chief part of the work, being a dictionary of watering-places and health resorts, with details as follows :—position, sea-level, season, special indications, doctors, hotels, etc. The summer and winter residences of doctors are also given, and a list of specialists, which appears to us rather invidious. The large map is printed in eleven colours, and shows the stations named, and an itinerary of the quickest and cheapest routes by rail, boats, carriages, etc. We think that the book cannot fail to be found serviceable to health-seekers.

An Elementary Class-book of General Geography. By Hugh Robert Mill, D.Sc., F.R.S.E., etc. London: Macmillan and Co., 1889. Pp. 365. *Price* 3*s.* 6*d.*

Dr. Mill's Geography is the most successful attempt that has yet been made to apply and carry out in practice the rational method of geographical instruction. If the book, or even if the method of the book, were generally adopted in schools, the result would be to revolutionise the teaching of the subject. The treatment is at once thoroughly scientific in its basis, and thoroughly popular in its details. Dr. Mill is complete master of both sides of the subject, and his skill and judgment guide him, as if by instinct, to determine where the first method should end and where the second method should begin. Nothing, for example, could be more instructive than his discrimination of the functions of geography and topography. While he admits the value of each, and describes the latter as being the proper basis of the former, he is careful to point out how they have been confounded in practice. Many persons—indeed, most persons, including most writers on the subject—treat geography as if it were merely topography, "a dry catalogue of capes, rivers, boundaries, and famous towns," which is equivalent to the mistake of giving prominence to the skeleton and overlooking the body, "of the greatest variety, beauty, and interest," which is built upon it. Dr. Mill does not make that mistake. No "dry catalogues" disfigure his pages. Physical features are mentioned in the course of the narrative, but only the most important or outstanding of these are given. Only the most important towns are mentioned, and these also are given in the midst of the narrative—in Scotland only seven—in England only twenty-three—in Ireland only six—and there are no lists of counties in any case. These, however, are in one sense exceptional cases, as the British Isles are fully treated in a separate volume of the series. But the same plan is followed in other countries. In France only thirty-one towns are mentioned, in Switzerland only eight, and in the whole German Empire forty-four. In the enumeration and grouping of the towns a novel plan has been adopted—novel because it is elastic, and varies with the character of the different countries. In Great Britain the guiding principle is the industries (the coal-fields and the agricultural districts). In France it is the almost geometrical railway system; in Germany it is the constituent members of the Empire; in Austria-Hungary it is the provinces. The plan is valuable, because its elasticity enables the author to give prominence to the prevailing features of the topography.

The index of such a work forms a safe measure of the amount of detail which it contains. The index of Dr. Mill's volume, of 365 pages, contains 2400 entries. It would be easy to mention smaller books which contain from 4000 to 5000 references. This is a proof of the sternness with which the tendency to go into details has been resisted.

The basis of the whole treatment is laid in three introductory chapters which, apart from their bearing on the plan of the book, have an intrinsic value. The first deals with geography in general, and carefully defines and illustrates physical, political, commercial, and historical geography. The illustration of a carpet, used to explain the great difficulty that occurs in the interpretation of map-projections in connection with contours, is admirably worked out. The second chapter deals especially with physical geography; and its discrimination of the lithosphere or stone globe, the hydrosphere or water globe, and the atmosphere or air globe is excellent and striking. The third chapter treats of

the life of the globe under the three heads of plant life, animal life, and human life, and each branch of the subject is adequately treated.

In the allotment of space, two considerations have been taken into account, —first, the area of the countries, and second, the density of population. The former consideration has led the author to give more than the usual space to such countries as Russia, Brazil, and the United States; the latter, to such countries as Belgium, Holland, and China. It should also be noted that the information which the book contains is derived from the best sources and is brought up to date. The style in which the book is written is at once forcible and picturesque. The pictorial illustrations are the weakest part of the book. They are prettily drawn; but they lack breadth and force. Varieties of typography have been freely used to distinguish the relative importance of places, and the book is furnished with a complete index.

A Class-book of Geography. By C. B. Clark, F.R.S. With 18 Coloured Maps. Revised Edition (302 pp.). London: Macmillan and Co., 1889. *Price* 3*s.* 6*d.*

Mr. Clark's Geography is drawn very much on the old and familiar lines. It abounds with the "dry catalogues" of physical features, counties, and towns, with their areas and populations, to which Dr. Mill so strongly objects. It has two redeeming points, however, which distinguish it from the old-fashioned books. It starts from a physical basis, and it contains a considerable amount of interesting information about the civil and natural history, and the industrial condition, of the several countries. The notes on the towns are, however, somewhat bald. No university town is mentioned either in England or in Ireland, and in Scotland only the University of Edinburgh is noticed, and that incidentally. Prominence is given to Ethnology, and to the means of communication, while "astronomic geography" and "chartology" are treated in the appendix. We note that the height of Ben Nevis is given at 4,368 instead of 4,406 feet. There is no index to the book.

Sir John Franklin; The True Secret of the Discovery of his Fate: A Revelation. By J. Henry Skewes, Vicar of Holy Trinity, Liverpool. London: Bemrose & Son, 1889. Pp. ix.+243.

We are here presented with a most extraordinary account of supernatural agency in the discovery of the fate of one of our most heroic Arctic explorers. The whole "revelation" appears an admirable subject for investigation by the members of the Society for Psychical Research, and to their attention we cordially recommend it.

Unknown Switzerland. By Victor Tissot. Translated from twelfth edition by Mrs. Wilson. London: Hodder and Stoughton, 1889. Pp. 361.

M. Tissot writes like an Impressionist with no fixed principles. The districts of Switzerland which he visited—Lucerne, the Engadine, Vallais, Gruyères—far from being "unknown," are quite familiar to the English tourist, at whom he loses no opportunity to scoff. When M. Tissot leaves the beaten track, as he does at one or two places, his narrative becomes more serviceable. At best, it is an entertaining and well-written account of a circular tour through Switzerland, though it is too much padded with anecdotes and digressions. The translation is very faulty.

NEW MAPS.

EUROPE.

FRANCE, Répartition Géographique de la Population en ——, ou *Densité de la Population* (Comune par Comune), par Victor Turquan, Lauréat de l'Institut, Chef du Bureau du Commerce et de l'Industrie. Echelle, 1:1,600,000.

Bulletin de l'Institut International de Statistique. Tome III., 1888. *Rome: Imprimerie Héritiers Botta.*

JAILA DAGH IN DER SÜDLICHEN KRIM, Geologische Karte des ——, nach einer Manuscriptkarte von William Paget Jervis (1855). Massstab, 1 : 500,000.

Deutsche Rundschau für Geographie und Statistik, Heft 9, 1889. *Wien: A. Hartleben.*

PROVINCIA DI NOVARA, Carta Stradale ed Industriale della ——. Scala, 1 : 500,000.

BIELLESE, Carta Industriale ——. Scala, 1 : 125,000.

Annali di Statistica, Statistica Industriale, Fascicolo XV., 1889. *Roma: Ministero di Agricoltura, Industria e Commercio.*

SCHLESWIG-HOLSTEIN, Übersichtskarte der Flora von ——. Entworfen von Ernst H. L. Krause. Massstab, 1 : 1,000,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 6. *Gotha: Justus Perthes.*

ASIA.

RUSSIAN CENTRAL-ASIA, illustrating the Trans-Caspian Railway and the Journey of the Hon. G. Curzon, M.P. Scale 1 : 5,900,000.

Proceedings of the Royal Geographical Society, May 1889.

JERUSALEM, Plan of ——. Reduced by permission from the Ordnance Plan, 1 : 2500 Scale, made by Col. Sir Charles Wilson, to illustrate recent discoveries. *Palestine Exploration Fund, April* 1889.

ÖSTLICHEN TIGRISARMES, Das Quellgebiet des ——. Aufgenommen und gezeichnet von Prof. Jos. Wünch. Massstab, 1 : 400,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 9. *Gotha: Justus Perthes.*

NICOBAREN-ARCHIPELS, Die Centralgruppe des ——, nach der neuen Karte der Survey of India gezeichnet von Dr. Svoboda. Massstab, 1 : 370,000.

GROSS NICOBAR, Karte von ——, nach einer Karte der Survey of India gezeichnet von Dr. Svoboda. Massstab, 1 : 370,000.

Mitteilungen der Kais. Königl. Geographischen Gesellschaft in Wien, No. 4, 1889.

AFRICA.

HERERO-LAND UND ANGRENZENDE GEBIETE. Nach vorhandenen Karten und eigenen Aufnahmen entworfen und gezeichnet von Franz Freiherrn von Steinaecker. Massstab, 1 : 1,000,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 5. *Gotha: Justus Perthes.*

LE HAUT-NIL ET LA COTE DE LA SOMALIE, Région comprise entre ——. Par W. Rosier. Echelle, 1 : 8,000,000.

L'Afrique Explorée et Civilisée, Genève, Juin 1889.

NORTH-EAST MADAGASCAR. Antanambalana River, surveyed by Mr. L. H. Ransome. *Proceedings of the Royal Geographical Society, May* 1889.

RUDOLF UND STEFANIE SEEN, Route der Expedition des Grafen Samuel Teleki vom Baringo-See zu den ——. Massstab, 1 : 2,500,000. *Mitteilungen der Kais. Königl. Geographischen Gesellschaft in Wien, No.* 4, 1889.

SANNAGA (MALIMBA) FLUSSES, Kartenskizze des ——, zwischen seiner Mündung und den Dewoa (Idia) Fällen. Nach dem durch die Fahrt S. M. S. *Nachtigal* im September 1888 gewonnenen Material entworfen von Prem.-Lieut. Kund. *Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten, Heft* 1, 1889. *Berlin: A. Asher & Co.*

GOLFO DE GUINEA, Posesiones Españoles en el ——. Escala, 1 : 5,000,000. *Boletin de la Sociedad Géografica de Madrid, No.* 1 *y* 2 ; 1889.

ZENTRAL-AFRICA, Originalkarte von Dr. W. Junker's Forschungen in —— in den Jahren 1877-78 und 1880-85. Nach den Tagebüchern, Kartenskizzen und mündlichen Mitteilungen Dr. Junkers, sowie nach allen vorhandenen Quellen entworfen und gezeichnet von Dr. Bruno Hassenstein. 4 Blatt. Massstab. 1 : 750,000.

SOUTH AMERICA.

GRAND CHACO SEPTENTRIONAL, Itinéraire de la mission de Brettes dans le ——. Voyage 1886-87-88. *Revue de Géographie, Juin* 1889. *Paris: Ch. Delagrave.*

KAART VAN GUIANA, Engelisch, Nederlandsch en Fransch. Naar de beste bronnen en eigen opnemingen geteekend in 1888 door. W. L. Loth, Gouvernements-Landmeter in Suriname. Schaal van, 1 : 1,000,000. *Uitgegeven met Goedkeuring van Zijne Excellentie Mr. H. J. Smidt, Gouverneur der Kolonie Suriname. Amsterdam: J. H. de Bussy,* 1889.

FERNANDO NORONHA, Geological Map of the Island ——. By George Ramage. *Proceedings of the Royal Physical Society,* 1888, *Plate* xix.

OCEANIA.

ISLES SAMOA, Carte pour servir à la Conférence sur cet Archipel par Marques. Echelle, 1 : 454,545. *Boletim da Sociedade de Geographia de Lisboa. No.* 1 *e* 2, 1889.

GENERAL.

EROSION DURCH GEZEITENSTRÖME, Neun Karten zu dem Aufsatze über ——. 1. Die Helgoländer Bucht, Massstab, 1 : 709,000. 2. Die Emsmündungen, 1 : 715,000. 3. Die Gironde, 1 : 705,000. 4. Port Santa Cruz, Patagonien, 1 : 1,000,000. 5. Der nordöstliche Teil der Fundy-Bay, 1 : 845,000. Port Gallegos, Patagonien, 1 : 1,081,000. 7. Liverpool Bay, 1 : 270,000. 8. Das Becken von Arcachon, 1 : 705,000. 9. Der Helder, 1 : 232,000. Von Prof. Dr. O. Krümmel. *Petermann's Geographische Mitteilungen, Jahrgang* 1889, *Tafel* 8. *Gotha: Justus Perthes.*

NEW ATLAS.

GÉOGRAPHIE ÉCONOMIQUE ET DES FORCES PRODUCTIVE DU MONDE, Petit Atlas de la —— par E. Levasseur, Membre de l'Institut, avec le concurs de Ch. Périgot, Professeur an Lycée Saint-Louis. Cinquième Année. Première Édition. Enseignement Secondaire des jeunes filles. *Paris: Librarie Ch. Delagrave. Price,* 8*s.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THE COCOS-KEELING ISLANDS.

By H. B. Guppy, M.B., F.R.S.E.

Part II.

COCOS-KEELING OR KEELING ATOLL.

(With a Map.)

It will be first necessary to obtain a correct conception of the true nature of an atoll. The usual description of a circular reef, bearing islands and islets and enclosing a lagoon or basin, gives an erroneous idea of the relative proportions of an atoll; and although I shall have to adopt such a method of description in this paper it will be necessary always to remember that I follow it only for purposes of convenience and clearness.

By drawing a section on a true scale across an atoll of average size it will at once become apparent that the foregoing description gives a misleading idea of the real nature of this class of reefs. A section across Keeling atoll drawn on a true scale of an inch to the mile from the ocean depths, and intended to illustrate a breadth of six miles, and its present depth in the lagoon of rather less than ten fathoms, would merely represent a flat-topped mountain, the situation of the lagoon being indicated by a very slight central depression of about $\frac{1}{100}$th of an inch, and therefore almost imperceptible to the naked eye. I have accordingly made a section representing a lagoon-depth of 30 fathoms which probably illustrates the original condition of the atoll, and may be taken as typical of most reefs of this class. It will be there seen that so trifling a proportion does the depth of an atoll bear to its breadth that such a reef can only be accurately described as *a level patch of coral reef with a slightly raised border*. It is a basin in no sense of the word, nature having disguised and exaggerated its true characters in such a manner that both the eye and the mind have been deceived.

Bearing this in mind, it follows that the characteristic feature of such a level coral patch, namely its slightly raised border, can be accounted for by an explanation much simpler and much nearer at home than one which comprises a subsiding movement of the earth's crust "immense in amount as well as in area" (Darwin). Whilst speaking of "bason-formed reefs" Mr. Darwin fully recognised that during the upheaval of such reefs above the sea, the characteristic rim would be readily removed by denudation, so that an upraised line of atolls would form a line of flat-topped mountains. This being so, it seems a little strange that he did not perceive that an atoll is merely a level patch of reef, and that its border is relatively but a little higher.[1]

We have, therefore, only to explain the origin of the slightly raised margin of a patch of coral reef in order to account for the characteristic feature of an atoll. It is, in fact, to the natural growth of corals rather than to a subsidence of the earth's crust that we must look for our explanation. Murray, following in the steps of Chamisso, the companion of Kotzebue the Russian navigator, has shown that when a coral reef nears the surface it will grow upwards more rapidly at the margins than in the centre, where the growth of coral is much retarded through the accumulation of sand and reef *débris*, and by the diminished supply of food. Hence the margins would first grow to the surface, forming a reef enclosing a lagoon. In the course of time islands and islets are thrown up on the reef by the breakers and a completed atoll is produced. Subsequently in the case of the larger atolls the islands on the reef develop a crescentic or horse-shoe shape, or may form secondary atolls or atollons, through the deposition of the sand and reef *débris* produced by the breakers. This last-named process constitutes the novel feature of this paper, and I shall have to refer to it in detail.

I will now commence my description of this atoll, which by the map accompanying this paper will be seen to be about 8 miles long, 6 miles broad, and not more than 8 or 9 fathoms deep. It exhibits itself on the map as a ring of semi-crescentic and horse-shoe islands which present their convexities seaward. The crescentic form is possessed in various degrees by different islands; some of the smaller ones are perfect horse-shoe atollons and enclose a shallow lagoonlet, others again exhibit only a semi-crescentic form, whilst the larger islands have been produced by the union of several islands of this shape. These islands are situated on a reef which constitutes the true border of the atoll and is continuous except on the north side, where there are two openings. In my description I will first refer to the reef or reef-flat, then to the islands and islets upon it, and afterwards to the lagoon it encloses.

The Reef or Reef-flat.—The islands and islets, as I have just remarked, lie on the exposed reef or reef-flat that invests the lagoon. It

[1] When we recognise the true dimensions of an atoll, and perceive how readily such a reef would lose its characteristic rim during upheaval, we can understand how in a region where atolls were numerous in some remote period of the earth's history we should now only find rounded patches of reef limestone.

is this reef, as Mr. Darwin observes, that "essentially forms the atoll," and he describes it as "a ring enclosing the lagoon on all sides except at the northern end, where there are two open spaces, through one of which ships can enter." At low-water it is possible to walk on this reef from Direction Island to West Island without encountering a greater depth than $2\frac{1}{2}$ or 3 feet, thus accomplishing the greater part of the circuit of the atoll. This reef-flat varies in places between 200 and 600 yards, being widest on the southern and western sides of the atoll. At high-tide it is completely covered, but at all tides there is a constant flow of water over a great part of its surface that finds its way through the passages into the lagoon. As its characters vary somewhat in different places I will describe it in different localities.

In the first place I will refer to the reef-flat opposite the southern passage between South and West Islands, where it is very wide. Between the islets in this passage, through which runs a constant current into the lagoon, corals and sand occur on the surface, the corals being mostly a massive and a branching species of *Porites* (the last being *P. palmata* (?), which, as remarked by Mr. Darwin, changes after its removal out of the water from a yellow colour to an inky-black hue). In addition there here occurs a small branching species of *Montipora*, which, with *Porites palmata* (?), is also found in the shallow water of the lagoon. In places the sand in this passage is almost covered with reticulated balls of a delicate branching Nullipore, varying in size up to the two fists, which give the surface a peculiar appearance. On the reef-flat outside the islets corals are very abundant, a massive *Porites*, often exposed at low-water, being by far the most common, the large flat-topped masses, only alive at the margin, and frequently some feet in diameter, being in some places so closely packed that they give the flat the appearance of a tesselated pavement. Next in frequency is *Porites palmata* (?) already referred to, together with another stout-branching *Porites*, and the slender branching species of *Pocillopora* (*P. brevicornis*, Lam.) that is also found in the lagoon. As we near the wash of the breakers, these corals give place to others that prefer the broken water. A stout bossy *Madrepora* (*M. formosa* ?) is the prevailing coral in the wash of the breakers, and for a little distance inside. The actual seaward margin of the reef is of solid Nullipore, encrusting corals raised usually about $2\frac{1}{2}$ feet above the level of the flat, and irregular in form, not a continuous convex mound such as Mr. Darwin observed in another part of the atoll,[1] but cut up into gullies across which plates of *Millepora verrucosa* (E. and H.)[2] stretched themselves. A peculiar-looking species of *Pocillopora* grows in the crevices and gullies of the Nullipore margin and on the flat just within it, its short compressed and blunted branches well fitting it to resist the force of the breakers. It was curious to observe how the Nullipore at the margin bridged across

[1] Mr. Ross informs me that the Nullipore margin is rarely as regular as Mr. Darwin's description implies: I am able to support the opinion of Mr. Ross, who is thoroughly acquainted with the features of his own atoll.

[2] I have been mainly guided by Mr. S. Ridley's and Mr. Quelch's determinations of the corals brought from this atoll by Mr. Forbes. The *Millepora verrucosa* is referred to by Darwin as *M. complanata*.

the tops of the branches of these breaker corals so as to form a level surface, leaving the interspaces between the branches to be subsequently filled up with reef detritus.

On another occasion I walked at low-tide along the reef from Direction Island to New Selima, a distance of more than a mile. There was a strong current setting in over the reef, which was covered by from 1 to 3 feet of water, so that in the deeper places it was as much as I could do to keep on my legs. More than half the area was bare rock, often encrusted with Nullipore, whilst a little sand occurred here and there. Large mats of Alcyonarians here flourished. The most frequent of the corals was a Millepore growing in plates, the general run of its plates being across the current.[1] Next in frequency was the bossy *Madrepora* (*M. formosa* ?) already alluded to as thriving in the wash of the breakers on the south side of the atoll. Then came the stoutly branched *Pocillopora verrucosa*, a massive species of *Porites*, occasional small clumps of a long-celled branching Madrepore, and an encrusting *Montipora*. Pink Nullipore covered much of the dead coral. In fact, in the strong current flowing in over the reef pink Nullipores, Alcyonarians, the *Millepora*, above mentioned, and *Madrepora formosa* (?) appeared most to thrive.

The Nullipore is an important agent in preserving from decay the dead coral of the reef-flat. Whenever the coral clumps attain any size they die in the centre, and this calcareous alga at once attaches itself to the dead portion. This was especially noticeable with the clumps of *Millepora*, *Madrepora*, and *Pocillopora*, the central dead tops of which were thus encrusted; and it was curious to observe how this Nullipore by its lateral growth finally bridged over the spaces between the plates or branches of these corals, forming a smooth platform on their summits, and leaving the empty interspaces beneath it to be subsequently filled up with sand and reef *débris*. I often stood on a clump of Millepore which had been covered over and concealed by the Nullipore in such a fashion that I appeared to be standing on a bare rock surface. It has been already remarked that more than half the area of the reef-flat in this part of the atoll is bare rock; and I formed the opinion that this appearance had been mainly produced by the growth of the Nullipore over the corals in the manner just described. As around the whole atoll, there is here a very extensive growth of Nullipore at the breaker-margin of the reef. Washed up on the reef-flat within the broken water were great slabs of rock mainly formed of this calcareous alga, and measuring 2 feet in thickness, and as much as 10 by 5 feet in length and breadth. They had evidently been torn off from the breaker-margin, and had been piled up on the flat to a height of 3 or 4 feet above the low-water level. In appearance the fractured surface of this rock is white and chalky, exhibiting no structure to the naked eye, and resembling some chalky limestones I found associated with upraised reefs in the islands of the Solomon Group.

[1] This Millepore grows in stout plates in the centre of the clump, whilst the marginal plates are slighter, and branch at the edges. For purposes of convenience, I refer to the hydroid corals as corals.

On examining the reef in the passage south of New Selima, I found the surface to be mostly of dead rock, whilst the Millepore, and an occasional bossy Madrepore, grew in the vicinity of and within the wash of the breakers. The Nullipore grew in knobs, half-a-foot thick, at the breaker margin. On the west side of the atoll, which is somewhat protected from the direct action of the trade-swell, the aspect of the reef-flat at low-tide is somewhat quieter. Its partly bared surface is dotted with shallow pools; but as it presents few features that have not been already alluded to, I need not do more than refer to it.

I have now to consider the mode of outward growth of the reef, on the flat of which the islands have been thrown up. It is this reef that, as I have already remarked, really constitutes the atoll; and in order to understand its manner of outward growth, it will be necessary to describe certain of its other features.

The weather was rarely suitable during my visit for the examination of the outer slope of the reef. However, when sailing outside the reef on one occasion off the northern part of West Island, Mr. Ross directed my attention to two parallel submerged lines of coral banks growing up outside the breaker-margin of the reef, and separated from each other by a sandy interval, which is clearly indicated even at a distance by the difference in the colour of the water. The inner line was covered with 5 or 6 fathoms of water, and 100 or 150 yards outside it was the second line, over which there was a depth of 10 or 11 fathoms; beyond this, the submarine slope descended rapidly to great depths. Mr. Ross, whose frequent fishing excursions have made him familiar with the outer slopes of the reef, tells me that what I observed in this locality is exhibited around the greater part of the circumference of the atoll, there being sometimes even three lines of submerged banks, separated from each other by belts of sand and reef *débris*, the innermost being covered by 4 or 5 fathoms, the middle bank by from 10 to 15 fathoms, and the outermost by from 25 to 30 fathoms. These banks are situated on a kind of ledge, varying in width from 200 to 500 yards, which is to be found outside the breaker-margin of the reef around the greater part of the atoll. Here ships can anchor; in fact, Mr. Ross has sometimes anchored in his schooner even on the ledge off the weather or eastern coast. These banks are usually indicated at the surface by the successive lines of rollers outside the breaker-margin of the reef.

It would thus appear that the seaward extension of this reef is effected not so much by the outward growth of the breaker-margin, as by the formation outside it of a line of growing corals, which, when it reaches the surface, reclaims, so to speak, the space inside it, which is soon filled up with sand and reef *débris*. The evidence, in truth, goes to show that a reef grows seaward rather by jumps than by a gradual outward growth, a conclusion that does not come into conflict with Mr. Murray's view that a reef grows outward on its own talus, such a talus being the necessary foundation on which the lines of submerged coral banks are successively advanced. It is, however, apparent that if my conclusion is correct, the reef-flat ought to present on its surface some evidence of its intermittent growth in the shape of ancient reef-margins.

We have already seen that the Nullipore margin of the reef, which is composed of Nullipore thickly encrusting corals, is raised between two and three feet above the general level of the flat; and it was the difficulty of supposing that this raised border had been always worn down to the level of the flat, whilst the reef grew continuously outwards, that raised a doubt in Mr. Darwin's mind as to the seaward growth of the reef. However, with a more extended field of observation, I can now say that here and there these ancient reef-margins protrude above the flat, occurring in lines near the beach, but broken up into patches, and often extensively hollowed and worn down by the waves. They are composed of large masses of the breaker corals, and display a rough bedding with a gentle inclination seaward. These ancient reef-margins are well represented on the reef-flat of North Keeling Island, where parallel lines of rudely bedded breaker-conglomerate protrude at intervals above the flat, the Nullipore crust in some places being still preserved.

The Islands and Islets.—I pass on now from the consideration of the reef-flat to the description of the islands and islets that have been subsequently thrown up on its surface. Generally speaking, these islands and islets are highest at their outer margins, where they are formed of loose coral blocks, raised from 6 to 12 feet above the reef-flat. They slope away towards the lagoon, being composed in their interiors mostly of unconsolidated sand. The loose materials of which they are formed rest on a solid foundation of a very hard conglomerate, well described by Mr. Darwin, which is often "exposed as a ledge, projecting some yards in front of the outer shore, and from two to four feet high," and has frequently "a waterworn and scooped appearance." Several bare level patches of this conglomerate rise up on the reef-flat on the weather sides of the atoll, being the foundations of islets that have long since been swept away, and I have described them below under the name of Button Islets, originally given to them in Van der Jagt's plan of 1829. This foundation of conglomerate in the outer or weather part of each island is composed of large blocks of the breaker corals, and of fragments of Nullipore, firmly cemented in a matrix of coarse calcareous sandstone, its surface often having a Nullipore crust several inches in thickness, and its mass being frequently "obscurely divided by seams, dipping at a small angle seaward" (Darwin). Such a rock now composes the raised margin of the reef in the wash of the breakers, and in this manner, I imagine, this similarly elevated foundation-rock of the islands was largely formed. However, as we approach the lagoon, we find that the conglomerate is composed of much smaller fragments of the same breaker corals, whilst in some places it is mainly made up of the coarse sandstone.

By forming an impermeable stratum beneath the loose sand and coral fragments composing the islands, this hard rock enables fresh-water wells to be sunk. It is, however, absent in those situations where ancient passages have been filled up with sand and reef *débris*, and also in those places where recent additions have been made to the land surface, and in consequence wells sunk in such localities afford only brackish water. The stratum of conglomerate exposed at the bottom of the wells is

usually one or two feet in thickness, and often overlies a bed of semi-consolidated sand of perhaps a similar thickness, underneath which another bed of conglomerate may occur.

I come now to the description of the individual islands, especially dwelling on their development of the horse-shoe or crescentic shape, and on their manner of gaining on the lagoon. A separate description is necessary, because we find that their characters vary considerably, and that each island has its lesson to guide us in the examination of the others. Afterwards I will proceed to consider the agencies at present shaping and extending these islands.

Direction Island.—This island, which is about three-quarters of a mile in length and some 300 yards in breadth, has a semi-crescentic form. Its general level is from 2 to 3 feet above high-water; but on its northern or seaward border coral blocks have been heaped up so as to raise its margin about 5 feet above the sea, whilst towards the eastern end the weather margin, similarly formed, is as much as 8 or 9 feet in height. The surface characters of this island tell the story of its different modes of growth. In the main it has been growing leeward or westward from its eastern portion by the formation of a succession of ridges of reef *débris*, each ridge thrown up by the waves, and marking a stage in the growth of the island. These ridges are naturally best illustrated in the western or more modern part, where the outermost or most recent of them have not yet been covered with vegetation, whilst the innermost are only scantily covered with littoral plants. The difference in age between the two parts of the island is also to be observed in the characters of the soil. In the western half the surface is usually more or less covered with loose coral masses; in the eastern or older part there is a much greater proportion of humus, and the surface is much less encumbered with loose corals. It is also noteworthy that although well-sinking has been hitherto unsuccessful in this island, fresh water has been recently obtained from a well sunk in its eastern or older part. It is true that a fortnight afterwards the water became brackish; yet this circumstance is sufficient to show that in the eastern part of the island the underlying foundation of conglomerate has had more time to consolidate than in the western portion.

Whilst growing westward, this island has increased its width by encroaching on the reef-flat at its seaward border. The process has been much the same. As the reef grows seaward the island also gains on the reef-flat by a succession of ridges, thrown up during heavy gales, the remains of which are still to be seen in its interior. There is yet a third mode of growth which this island illustrates. I have referred above to its semi-crescentic form; this is a more modern effect due to the curving inwards towards the lagoon of the extremities of the island through the influence of the currents, a process that tends towards the production of a horse-shoe form. The western end illustrates this process especially well. Here the incurving end is prolonged by a growing sand-bank, stretching into the lagoon, on which the vegetation of the island is rapidly encroaching. The fourth mode of growth at the lagoon margin,

well exhibited in other islands, is not well shown here. Direction Island, however, in its growth serves to illustrate, with this exception, the growth of all the islands. In a general way it may be stated that after the original or parent islet has been thrown up on the reef by the breakers, the island attains its length by extending along the trend of the reef through the accumulation of reef *débris*. After a little time it grows in width by advancing at its outer border towards the breaker edge of the reef, and by gaining on the lagoon at its inner margin through a reclaiming process to be subsequently described. In course of time the extremities of the island will grow inwards, a process which may ultimately produce a horse-shoe island. . . . In these remarks I have thought it wise to in some measure indicate in advance the methods of growth of these islands, in order to avoid unnecessary repetition whilst discussing the other islands.

Workhouse Islet, which is mostly of sand, and about 6 feet in height, bears a conspicuous coco-nut palm leaning seaward. Van der Jagt, in 1829, described it as a sand-bank 150 feet long and 100 feet broad.

Prison Islet, 20 feet high, is formed mostly of blown sand, which displays no arrangement, and is not consolidated. It is at present mostly covered with bushes and trees of *Scævola kœnigii* and *Tournefortia argentea*, together with coco-nut palms. It does not seem to have altered much since 1829, when Van der Jagt says that it bore twenty-five coco-nut palms, and was 20 feet high, and 250 feet in circuit.

Clunie Island, the present burial island, is separated from the adjacent larger island of New Selima by a narrow passage, which is covered in the deepest places at the lowest tides by not more than 2 feet of water. This island is tending on its lagoon-side to assume a crescentic form by the growth of sand-banks, partly exposed at low-tide, on which the vegetation of the island is encroaching.

New Selima Island is usually elevated between 2 and 4 feet above the sea, but on the outer or weather margin coral blocks have been heaped up to a height of 6 feet; whilst near the inner border, in the vicinity of the Bantam village, unconsolidated sand has accumulated until it has attained a thickness of 9 or 10 feet. In recent years the northern end of the island, on the lagoon side, extended itself about 70 yards, the new tract being partly clothed with young casuarina trees and young shrubs of *Scævola kœnigii* and *Tournefortia argentea*. At the southern end of the island, on its inner margin, there is a lagoonlet, now almost dried up, and presenting a dry tract of sand and mud, on which grow in places scattered tufts of grass, whilst patches of *Ipomœa pes caprœ* are encroaching upon its surface. Some thirty years ago, this lagoonlet, now only partially entered by the sea, was deep enough to float a boat, and it used to be a favourite resort for those who were in quest of the sea-birds that were perched on the trees around its margin.

THE "BUTTON ISLETS" OF VAN DER JAGT.[1]—This Dutch officer applied this name to three bare islets lying between the present named Prison Islet, Clunie Island, and New Selima Island. In their absence of vegetation he compared them to a sand-bank between Prison Islet and Workhouse Island. These so-called islets at present are merely patches of the reef-conglomerate, and apparently once formed the foundation of islets that have been swept away. Similar patches occur between the islands lying south from New Selima as far as the northern end of South Island. They are mostly bare, as in the case of one in the passage south of New Selima; but may sometimes be covered with bushes of *Pemphis acidula*, as in the instance of another lying close to the north end of this island. They are all made up of blocks of massive corals and stout Madrepores cemented together in various positions, some of them in the position of growth. Since they are not usually elevated more than $3\frac{1}{2}$ feet, and never more than 5 feet above the ordinary low-water level, most of them are but partially exposed at high tide. In fact, they have been often extensively eroded and hollowed into deep pits by the waves; and at the present day would merely be regarded as for the most part bare rocky patches.

SCÆVOLA ISLET, next to the bare rocky patch, off the south end of New Selima Island, is an islet not named in the Admiralty Chart; and I have named it as above for the convenience of reference. It is from 4 to 6 feet high, is composed on its outer side of loose coral blocks, and supports one or two coco-nut palms, together with bushes of *Scævola kœnigii*.

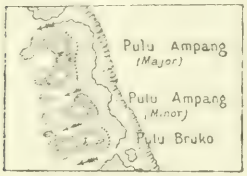
THE AMPANG ISLANDS, or STEWARD'S GROUP, include the three small islands lying to the south of Scævola Islet. The name of Steward's Group is that given to them in Van der Jagt's plan of 1829; and it correctly indicates that they form an independent group situated on the same patch of reef-conglomerate, and separated by permanent passages from the islands north and south of them, each of which has its own foundation of conglomerate. Pulu Ampang Major is an interesting example of an atollon or secondary atoll, which has assumed its horse-shoe form since the island was first thrown up by the waves, as the result of the growth of sand-banks which prolong its extremities leeward into the lagoon. In recent times the mouth of the horse-shoe has been crossed by a bank, covered with bushes of *Pemphis acidula*, and leaving only a narrow passage about a dozen paces wide leading into the lagoonlet. The lagoonlet, now 80-100 yards across, was evidently at one time much larger. At low water shallow pools half-a-foot deep dot its white chalky surface: at high tide it is covered by about $1\frac{1}{2}$ feet of water, but within the memory of Mr. Ross it had a depth of 3 feet at high water. It is evidently silting up.

Pulu Ampang Minor has no lagoonlet; but Pulu Bruko has a tiny

[1] Van der Jagt, in his map of 1829, employs names different from those now used for several islands of the atoll (See *Verhand. Batav. Genootschap der K., Deel* xiii.; 1832).

lagoonlet on its inner side, now cut off at low tide, and containing less than six inches of water. When Mr. Ross was a boy, it was deeper and larger, and was a favourite resort for catching mullet.

At low water these three islands, as indicated in the small accompanying plan, are connected together on the outside by the dry reef rock; but towards high tide the sea overflows the reef, and there is a continuous rush of water through the temporary passages. By the encroachment of the vegetation on either side the gaps between the islands are rapidly closing in, so that in the course of time these three islands will unite towards their outer borders. This is especially the case with Pulu Ampang Minor and Pulu Bruko, bushes of *Pemphis acidula* nearly joining them together. It has long been surmised that the largest islands of this atoll had originally a compound origin; and here we have an illustration of the process of union. At the lagoon end of each of the two passages, so called, that separate these three islands, a sand-bank or shoal has been formed, and the shoal between the two northern islands now bears a pretty coco-nut islet. These shoals are extending laterally, so that at no distant date the islands will be united at their inner margins as well as at their outer borders, and two lagoonlets will represent the original gaps between the islands. Here we have, as I shall subsequently explain, the key to the origin of North Keeling Island, and I may here remark that I was originally indebted to Mr. Ross for directing my notice to this unusual mode of formation of a lagoon, and for the suggestion that it would remove my difficulties in connection with this island. (The bearing of these facts will be referred to when I come to sum up my remarks.)



THE AMPANG ISLANDS
(Keeling Atoll.)
The arrows indicate the direction of the currents running through the passages into the lagoon.

PULU KUMBANG has no lagoonlet, and needs no special reference.

GOOSEBERRY ISLAND, the Armstrong Island of Van der Jagt's map, originally consisted of two or three smaller islands, and thus represents the future condition of the adjacent Ampang group, above described. In one place, where the island is only 50 yards across, the line of junction between its northern and southern portions may still be traced. Here there is little or no soil, the surface being strewn either with loose coral blocks or with blown sand. The inner border of this island is deeply indented along its whole length by a series of more or less perfect lagoonlets open to the lagoon, which are especially well shown in the southern half, where they are mostly dry at low water, and are crossed at their mouths, as in the case of the lagoonlet of Pulu Ampang Major, by sand-banks, clothed with *Pemphis acidula*, that tend to shut them off from the great lagoon. This reclaiming agency by the closure of the mouth of the lagoonlets of the various islands is in progress all around

the lagoon shores of the atoll; and it is the principal method by which the islands are gradually gaining on the lagoon.

Pandan Island is an example of a horse-shoe atollon, one-third of a mile across, and exhibiting the mode of origin of these horse-shoe islands in a very unmistakable manner. The lagoonlet is partly dry at low tide, the water then remaining being less than a foot deep, whilst the turtle-grass growing on the bottom is just exposed. The surface of the lagoonlet is formed of sand and mud. The two arms of the horse-shoe are rapidly extending into the great lagoon, especially the southern arm, which is continued as a shoal of sand, curving to the north-west, the surface of which is being occupied by the gradually advancing littoral vegetation. It is evident that the mouth of the lagoonlet will soon be closed, and that this will be followed by the obliteration of the lagoonlet, the area of which will in course of time be occupied by the vegetation of the island, or, perhaps, before this occurs, the surface will be planted with coco-nut palms by the proprietor.

There is nothing in the small islands intervening between Pandan Island and South Island that calls for special notice, so I will proceed to the description of the large South Island.

South Island, or South-East Island, which has a sweep of some 5 miles, and a breadth varying between 150 and 1000 yards, has had its origin in the union of several smaller islands. We know from Van der Jagt's plan of 1829, and from Fitzroy's plan of 1836, that these passages must have closed up before the occupation of the atoll sixty years ago. In truth they must have been obliterated at a much earlier date, seeing that they are not indicated in an old plan of the atoll, which was published in Van Keulen's Atlas in 1753, a plan that may have been made even in the seventeenth century, since it bears neither the author's name nor the date.[1] Mr. Leisk informed Mr. Darwin in 1836 that he had seen an old map in which this island was divided up into several islets: Mr. Leisk, as Mr. Forbes points out,[2] was not always accurate; and I prefer, therefore, the testimony of the early map in Van Keulen's Atlas to uncorroborated second-hand information. However, these ancient passages are even now traceable by the narrow necks occurring in different parts of the island, by the absence of soil on the surface, which is formed of loose coral blocks, by the open character of the wood growing upon it, and by the absence of the underlying reef-conglomerate that forms the foundation of the original islands. In wells sunk in such ancient passages Mr. Ross is unable to obtain fresh water, owing to the absence of the impermeable foundation of reef-conglomerate. This can be readily understood if we imagine the passage between two small islands, each having their own foundation of reef-conglomerate, such as Pulu Bruko and Pulu Kumbang, to become filled up with sand and reef *débris*. Vegetation would soon spread over the newly-formed neck, but for a long time the

[1] This map will be given in the next part of this paper.

[2] *Eastern Archipelago*, p. 15.

surface would be formed mainly of loose coral fragments and sand, and, owing to the absence of the foundation of reef-conglomerate, a well sunk there would yield only brackish water.

The seaward or outer border of the northern part of this island is, for the most part, composed of large coral blocks heaped up usually 7 or 8 feet above high water, but attaining a height of 11 or 12 feet at the South-East Bend, which is the most exposed part of the whole coast. This angle of the atoll receives the first brunt of the Trade-swell, with only the reef-flat to lessen its fury. Here the conglomerate, forming the foundation of the island, has been extensively exposed, and worn back into faces 3 feet in height. Over all is a massive-looking slope of large blocks of coral, forming a kind of glacis, which has itself in places been worn back by the breakers. Stunted pandans, and similarly stunted bushes of *Scævola kœnigii* and *Tournefortia argentea* crown the summit of the slope, affording in their appearance mute testimony of the frequent violence of the Trade-blast. The outermost pandans, which bear the full force of the wind, are only 5 or 6 feet high, and have a very sorry appearance; but their protection enables the pandans immediately inside to grow a little higher, and these in their turn perform the same service for those still further in, until by this process of mutual protection the innermost pandans attain a fair height, and the gently rising plane of their summits offers but little resistance to the gales. I have sat for an hour on this South-East Bend, admiring the manner in which this weathermost angle of the atoll braved the elements. Its natural glacis of loose coral blocks, and its crown of stunted pandans at once explained how the land was able to resist the fury of the breakers in the heaviest gales, and the manner in which the vegetation combined to face the storm. The remainder of the seaward margin of the island, to the southward and westward of the South-East Bend, is for the most part composed of blown sand, and rises usually from 12 to 15 feet, but in some places as high as 20 feet. The old trees of *Tournefortia argentea*, that border this part of the coast, are often partially buried in the sand, and some have been in this manner killed.

The inner or lagoon border of South Island may be described as consisting of a number of semi-circular bays, varying in width from 100 or 200 yards to half-a-mile or more, and surrounding bare white chalky mud-flats which are exposed at low tide. The smaller bays are converted into crescentic lagoonlets by long banks of sand that nearly cross their mouths; on these banks *Pemphis acidula* finds its home, and occasionally young coco-nut palms have been planted upon them by Mr. Ross. Similar banks, clad with the Pemphis bushes, tend often to close in the larger bays to a greater or less degree at low water; all along the lagoon margin of this large island, we observe the broad expanses of chalky mud-flats, their glaring whiteness being partially relieved by the lines of Pemphis-covered banks that stretch across them. At high tide the lines of Pemphis bushes alone are seen, and then we perceive the extent and character of this reclaiming process which is in operation all around the lagoon shores of the atoll. The small and larger bays, or the lagoonlets, as they may be more aptly termed, are being gradually filled in by the

reclaiming influence of the bush-covered banks or bars that more or less cross their mouths; and here and there we can see how the bordering vegetation, led on by such plants as *Ipomœa pes caprœ* and *Triumphetta procumbens*, is gradually invading the enclosed chalky flats, the surface of which, in not a few instances, may be already dotted with patches of the Pemphis bushes. Into the origin of these lagoonlets or semi-circular bays, and of their outlying sand-bars, I shall enter later on; it will be sufficient here to point out the manner in which this island, like all the other islands, is gaining on the lagoon, a circumstance which the proprietor sees with no displeasure, since Nature unassisted increases the number of his acres. Often, however, Mr. Ross hastens the process by planting on the newly gained land almost before the sea has finally relinquished its hold, and coco-nut palms now flourish in many places that were occupied by the waters of the lagoon in his youth.

I should add that the west end of this island is rapidly extending lagoonwards, thus exhibiting in a marked degree the peculiar incurving of the extremities of Direction Island, Gooseberry Island, and the smaller islands already described.

The Islets of the South Passage.—These four islets are founded on patches of reef-conglomerate which is composed mostly of small coral fragments and coarse sand, Burial Islet and East Cay lying on the same patch. East Cay has a crescentic form on its inner side, and was evidently at one time a more characteristic horse-shoe islet than it is at present, the original lagoonlet being nearly silted up, whilst vegetation has greatly encroached on its surface.

West Island, or Ross Island, which is the most extensive island of the atoll, has a sweep of about 6 miles, and a width varying from 100 yards to rather over half-a-mile. Like South Island, it has had a compound origin, and the narrowest portions or necks often mark the situations of the ancient passages. As in the case of South Island also, there is evidence to show that the passages have not been recently closed. We find no indication of them in Fitzroy's plan of 1836, or in that of Van der Jagt made seven years before, and when we refer to the plan, published without any clue to its origin or date, in Van Keulen's Atlas of 1753, we perceive that West Island was one large island when that early plan was made.

The scene on the outer or seaward margin of this island is generally very different from that which one witnesses on the weather-beaten coasts of South Island. Being for the most part sheltered from the south-east Trade, the water on the reef-flat is less disturbed, and outside the reef the sea is comparatively quiet; but every quarter of an hour a succession of huge rollers from the SW. or SSW. roll quietly in and break on the edge of the reef. The sloping mass of large loose coral blocks, that the breakers have thrown up to protect the South-East Bend against their fury, is here replaced by a white sandy beach nearly free from coral boulders. The heat of the sun is more oppressive from the absence of the cool blast of the Trade; and the trees and shrubs

bordering the beach, chiefly *Scævola kœnigii* and *Tournefortia argentea*, grow under these more favourable conditions to a greater height, and make a greater display of flowers and foliage.

Coming to the more detailed description of this island, I will refer first to its incurving southern extremity, which illustrates in a remarkable manner the action of the currents through the passages in shaping and extending the two ends of an island by the distribution of the sand and reef *débris* transported by them into the lagoon. The southern end of West Island has been curved lagoonwards, and has attained considerable breadth through the formation of a series of parallel incurving banks of sand, five or six in number, each of which marks a stage in the inward growth of this extremity of the island. The present Turtle Islet[1] has been formed on the principal of these banks; and in the early days of the occupation of the island, some sixty years ago, it formed the prolongation of this end of the island. But in more recent times two similar, though smaller, parallel banks have been thrown up outside it. The space reclaimed by them, which has been planted with coco-nut palms, represents an encroachment on the lagoon to the extent of about 200 yards. Even within the last few years, two other banks have been formed outside these banks. They are about 20 paces apart, and bear each of them a scanty line of bushes and young trees of *Scævola kœnigii* and *Tournefortia argentea*, the highest in September 1888 being about 8 feet. In a short time, as in the former case, Mr. Ross will plant coco-nuts on the ground they have regained. It is from the sand and reef *débris* brought into the lagoon by the rapid current through West Cay Passage, especially during gales, that all these banks have been mainly formed. Each bank is marked by a point, and thus the inner border of this end of the island has the appearance of a saw.

By the successive formation of these parallel incurving sand-banks, of which Turtle Islet marks by far the largest, the great southern lagoonlet of West Island has been formed. This lagoonlet presents at low tide a large bare expanse of chalky mud. Within the memory of those living on the atoll, it has shoaled to such an extent that large boats formerly accustomed to enter it cannot enter now. Here the process of reclaiming is in operation on a large scale; and, in truth, Turtle Islet is extending itself at its west end in such a manner, that it will in the course of time close the entrance to this large lagoonlet.

Near the middle of the inner margin of West Island there is the entrance to another large lagoonlet, the surface of which is formed like the other of chalky mud, which is partly covered at high water, but is completely dry at low tide. We learn from Van der Jagt's map that in 1829 this lagoonlet was dry at low tide, but covered by 4 feet at high water. It has evidently been gradually silting up, and its extent, as I learn from Mr. Ross, has undergone considerable diminution by the advance of the marginal vegetation on the chalky mud-flats. In one place an acre or more was permanently reclaimed by the obliteration of an inlet through the collection of Krakatoa pumice.

[1] This islet is at present separated at low water from the adjacent point by a narrow passage nearly dry, except in its centre, where there is a depth of 1½ feet.

At the head of this northern lagoonlet there was originally a passage cutting through West Island; and I am inclined to think that the long arm mainly shutting in this lagoonlet commenced its existence as a sand-bank before this ancient passage was closed, just as similar banks have been formed, as already described, at the inner ends of the present passages between the Ampang Islands. The situation of this ancient passage is here indicated by the narrow width of the island (90 or 100 yards); by the loose coral blocks, with but scanty soil, on the surface; by the scattered arrangement of the trees growing there; and by the sudden contraction of the width of the reef on the seaward side of the island, where the conglomerate foundation of the island is exposed on the beach. It would in truth appear that in the early history of the island there was not only a wide passage here, but a deep channel caused by a gap in the reef mass. Other passages, in more modern times probably, also cut through the island; but none of them have been shown in any of the early plans of this atoll. One, as indicated by a double line in the map attached, cut off the south extremity of the island, and, probably before its closure, the bank on which Turtle Island is placed had already begun to form. Here the belt of land is only 60 yards across, and the outer entrance of the old passage is marked on the beach by the extensive exposure of the foundation conglomerate which was then worn back by the waves into low water-worn faces that still remain.

The northern portion of West Island has within the memory of the residents been increasing in two ways. Banks of mud and sand, derived from materials brought in through the adjacent passage, and washed off the neighbouring point, have been formed along its inner margin, enclosing lagoonlets that are now filled up. In this manner, as Mr. Ross informs me, some 300 or 400 yards have been added in recent times to the width of the island. In places where there were shallow lagoonlets half-a-century ago, we now find tracts, somewhat marshy from the collection of rain-water, on which coco-nut palms have been established. Then again it is evident that, although the northern point of this island has suffered some loss in times past, it is now working northward and lagoonward again, as indicated by the shoal that prolongs it, and by the young plants, only 1 to 2 feet high, of *Scævola kœnigii* and *Tournefortia argentea*, that occupy this extremity of the island.

Horsburgh Island.—This island is nearly a mile in length, and about 800 or 850 yards in width. It was originally an atollon, or secondary atoll, open to the north. At present, however, the lagoonlet is nearly filled up, and is represented by a salt-water lakelet about 200 yards in length, and 2 or 3 feet deep at low tide. Though now separated from the north coast by a narrow barrier formed of loose blocks of coral, it has an indirect communication with the sea by percolation. On this intervening barrier are still standing, in good preservation, the stumps of huge ironwood trees (*Cordia subcordata*), that were burnt half-a-century ago. As already remarked, these trees grow very slowly, and, judging from the rate of growth observed by the residents, the trees originally

growing on this barrier must have taken centuries to attain their great size, a circumstance which goes to show that this salt-water lakelet has long been cut off from direct communication with the sea, though sufficient time has not since elapsed for the growth of a protecting reef-flat on the north side of the island. Horsburgh Island, in fact, represents the last condition of an atollon, the earlier stages being illustrated by Pandan Island and Pulu Ampang Major. In recent years the principal changes in this island have occurred at its inner or southern margin, which has grown lagoonward. About fifteen years ago, Mr. Ross made a small boat-harbour of large coral blocks on this shore; but it has become silted up with sand and is now useless, whilst the adjacent beach and vegetated surface has advanced twenty paces or more on the lagoon.

The Agencies at present shaping and extending the Islands and Islets.—When in the Solomon Islands I formed the opinion that small atolls and horse-shoe islands, such as are often situated, as in the case of Keeling atoll, on the borders of large atolls, owed their characteristic shape to the guiding influence of the prevailing surface-current (*Proc. Roy. Soc. Edin.* 1885-86, p. 900); but I had no clear conception of their mode of development, and it was not until I visited Keeling atoll and there saw the process in actual operation that I was enabled to perceive how these secondary atolls are really formed. Strangely enough I found that Mr. Ross, as the result of his life-long observations of the changes in the atoll, had arrived at a similar explanation, and it has very lately come to my notice that Dr. Bassett-Smith of H.M.S. *Rambler*, after his recent examination of the islands and islets of the Tizard Reef, formed a similar opinion of the origin of the horse-shoe islands and atollons that are sometimes situated on the circumference of large atolls.[1]

In my description of the several islands and islets, I have frequently referred to the circumstance that their extremities, curving inward towards the lagoon, are merely banks of sand which have been formed from the materials brought in by the currents through the passages between the islands, and heaped up in such a manner as to prolong the extremities of each island lagoonward in the form of two horns. In the case of the larger islands, a crescentic form is thus developed, and in the case of the smaller islands a more perfect horse-shoe shape is attained; but it is only when the two horns of sand are vegetated that the island exhibits this characteristic outline. In several cases the vegetation has but just begun to occupy the banks, and there is then merely an island prolonged by two bare sand-banks into the lagoon. All the stages in truth are exhibited, from the islet recently thrown up on the reef to the perfect horse-shoe atollon.

Mr. Ross and I explained in the following manner the origin of the crescentic and horse-shoe shapes of the islands and islets on the margin of Keeling atoll. We both likened the process to the formation of a V-shaped ridge of sand when a stake or some other obstacle, such as a stone, has been placed in a river-bed. Whilst the stone represented the

[1] *Report of an Examination of the Tizard and Macclesfield Banks* (Hydrographic Department, 1888).

original small island thrown up on the reef by the breakers, the V-shaped ridge of sand represented the arms of the horse-shoe island, which are similarly formed of sand; and just as the extremities of the V would in the course of time converge behind the obstacle, so in the case of a horse-shoe island the horns would tend to approach each other. It would thus appear that three conditions are necessary, the obstacle, the constant current, and the supply of sand.

In order, however, to satisfy myself that this view was correct, I had to ascertain the reality of the three conditions in Keeling atoll. It was essential to learn how and to what extent the surface-currents acted, and to discover the source of the sand. The Westerly Drift, or, in other words, the surface-current produced by the Trade, which blows usually from ESE. or SE. during the greater part of the year, strikes the south-eastern shores of the atoll. Being there divided, it sweeps around the coasts, the two branches meeting and forming an eddy off the north-west angle of the atoll opposite Horsburgh Island, where driftwood and wreckage usually collect. Mr. Ross takes advantage of this current in transporting any valuable timber that has been thrown up on the weather coasts. In the course of time, he tells me, these timbers, if launched again beyond the breakers, are invariably to be found off Horsburgh Island, or stranded on its shores. This current finds its way over the reef into the lagoon through the several passages between the islands, its rate varying usually from half a knot to two knots, according to the state of the tide, the size of the breakers, and other conditions. Only rarely is there any check to the inflow of water, as, for instance, during north-west gales.

It was the accidental circumstance of finding a quantity of fine calcareous sand in my tow-net whilst using it in one of the passages for collecting minute surface animals that first directed my attention to the transportal of sand into the lagoon. By carrying a line across one of the narrower passages, to the middle of which I fastened the net so as to keep it a foot above the bottom, I soon satisfied myself that a large amount of fine sand was brought in through the passages. No other precautions were necessary except careful watching, as the constant set of the current kept the net in position. Subsequently I made a considerable number of observations in different passages at various states of the tide, at different depths, and during the varying conditions of the breakers, arriving at last at the conclusion that the minimum amount of sand daily carried into the lagoon was about ten tons.[1] My method of estimation consisted in estimating the average sectional areas of all the passages and the receiving area of the net. The net was usually kept in position for an hour at a time, when the sand thus collected was carefully incinerated and weighed.

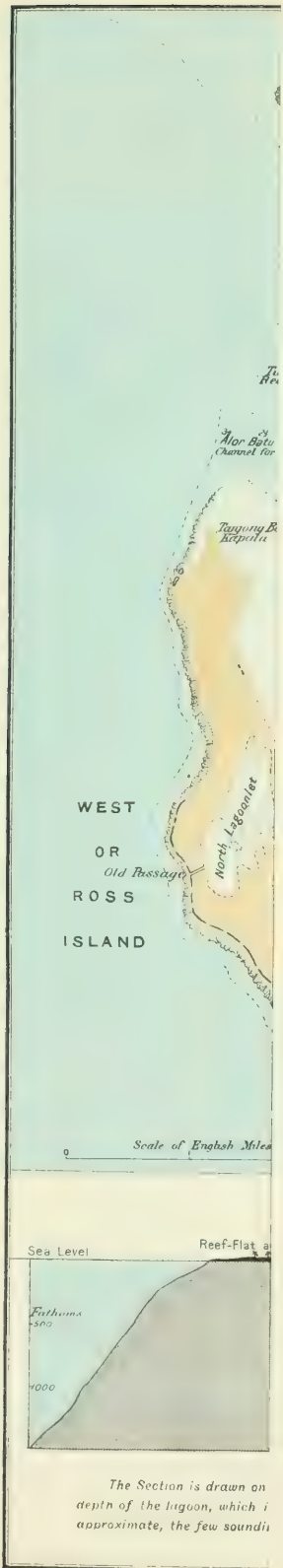
The water always seemed perfectly clear, even when there was most sand. The quantity of sand increased with the depth, being greatest at

[1] I assumed the average depth of the passages to be two feet at all states of the tides. The passages must not be confused with the deep and wide openings or gaps in the reef on the north side of the atoll.

the bottom, and of course increased with the force of the current. The size of the particles also varied with the depth of water and with the force of the current. Usually the average size of the larger calcareous particles, when the net was kept a foot off the bottom, was from $\frac{1}{70}$ to $\frac{1}{100}$ of an inch; but along the bottom and a foot above it, especially when the current was rapid, much larger particles were carried in, and I sometimes observed in my net calcareous joints of *Halimeda opuntia*, $\frac{1}{5}$ of an inch across, together with large tests of macroscopic foraminifera and large Alcyonarian spicules. When the sand thus collected in a tow-net is allowed to settle in a glass of water it gets a slight fluffy covering composed of soft-tissued minute surface animals, crustaceans, confervæ, and marine vegetable matter. On removing these materials by gentle incineration, the sand will be found to be in the main made up of amorphous calcareous grains with a small proportion of other matter consisting of Alcyonarian and sponge spicules, and of the tests of foraminifera and diatoms.

I have taken the minimum daily amount of sand transported into the lagoon at ten tons. However, Mr. Ross, who followed my experiments with interest, tells me that this can only apply to ordinary weather, and that during and just after heavy gales the passages are swept clean by bore-like rollers that rush in through them every quarter of an hour or so. On one occasion two children were in this manner carried off their feet and drowned. Probably, therefore, I should not be far wrong in placing the annual amount at 5000 tons. The source of this sand is to be found mostly in the unceasing action of the breakers on the weather-edge of the reef. Nearly all of it is deposited at and near the margin of the lagoon. The current through the passage becomes checked and often imperceptible as it enters the deeper water of the lagoon, but the passage itself is usually kept patent, and the sand is heaped up on either side of the inner end of the passage in the form of two sand-banks stretching away into the lagoon. Or, to state the matter in other words, the current over the reef, on striking the island, is divided, and, passing into the lagoon on either side, deposits its sand on getting into the deeper water in the form of two sand-banks prolonging the extremities of the island lagoonward. Thus arises the horse-shoe or crescentic form of the island. During a limited portion of the year a westerly swell sets across the lagoon from the exposed north-west opening of the atoll, and then there is a tendency to the formation of a bank or bar of sand across the mouth of the horse-shoe or the crescent. Thus we explain the origin of the bars that have been thrown across the mouths of the numerous lagoonlets, which I have already described. I have before referred to the exceptional instances when owing to the same westerly swell a bar of sand has been thrown across the inner mouths of the passages between the Ampang Islands, giving the appearance, as in the case of North Keeling Island, of a lagoonlet, open on the weather side instead of on its lee side.

(*To be continued.*)



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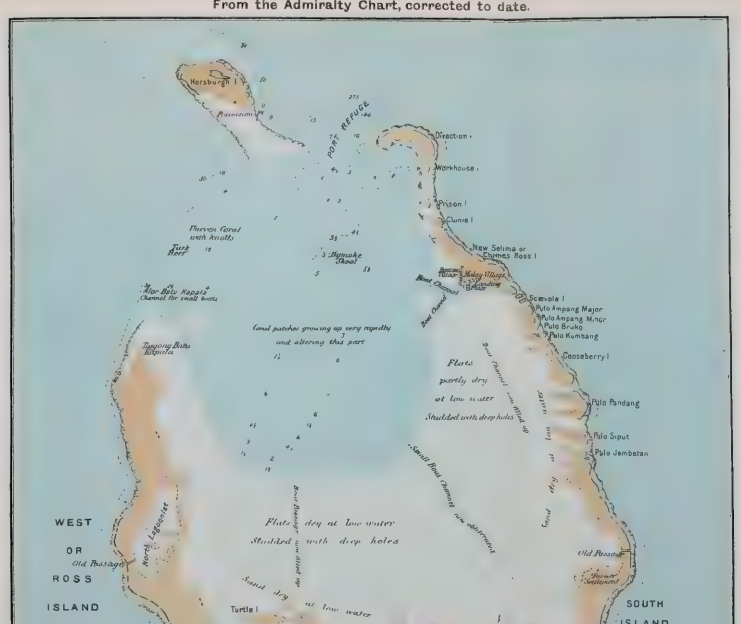
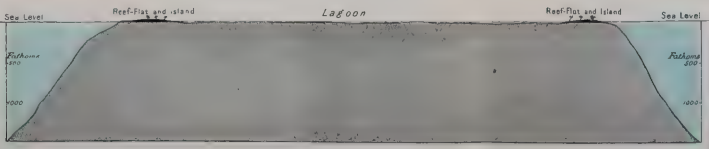
THE COCOS OR KEELING ISLANDS.

From the Admiralty Chart, corrected to date.



SECTION ACROSS KEELING ATOLL.



The Section is drawn on a true scale of 1½ miles to an inch, from a depth of 1,500 fathoms. The scale is too small to represent the actual present depth of the lagoon, which is under 10 fathoms, so the original depth—probably about 30 fathoms—is here indicated. The submarine profile is only approximate, the few soundings of Fitzroy having been used as a guide.

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THE ZAMBEZI DELTA.

By Daniel J. Rankin, M.R.A.S.,

Ex-Acting Consul at Mozambique.

The delta of this magnificent river may be said to cover an area of 2500 sq. miles. It commences some 90 miles from the coast, at a point a little below the confluence of the main stream with the Shiré River, for here during the rainy season its waters overflow into the marshy tract of country lying to the north of its left bank, and a small portion of this overflow finds its way to the Quaqua or Quillimane River in a narrow reed-choked channel named the Barabanda. This channel cannot strictly be called a part of the Zambezi, as it is merely a drain that receives and carries away the surplus water of the morass of which it forms a part. At frequent intervals it widens into more or less open swampy depressions, allowing a canoe or light-draught boat to be punted or paddled with difficulty during a few months in the year. At other times it can often be crossed dry-footed.

Passing this periodical outlet coastwards the first real branch of the main stream is the Mosella River on the right bank, about 35 miles from the sea. This river has for its mouths the Kongoni and Melambe. Five miles further down the Maria and Inhamacatiue Rivers branch off from the left bank, and 4 miles below the latter is the Chinde River. These three rivers have two common outlets separated by the island of Mitaone some 20 miles from the main stream.

Four miles below the Chinde, and on the right bank, is the Madredane channel, flowing into the Mosella River mentioned above. Lower down are the Katrina and Inhangurué channels, the latter flowing into the Kongoni mouth of the Mosella River.

The whole extent of this region south of the Mosella branch has nowhere an altitude exceeding 100 feet above sea-level. Towards the sea-board the altitude gradually decreases till, in many places extending for a distance of several miles from the shore-line, the country is below high-water mark, and is at high tides entirely submerged. The soil in these inundated districts is a soft light-coloured mud, impregnated with salt and vegetable matter. It is densely covered with mangroves that in some places grow to a great height, and give the lower waters of the river the appearance of being enclosed by an unbroken wall of tangled vegetation. At low tide a wide border of loathsome slime and mud appears on either side of the discoloured streams. This district presents a network of small channels, many of them splitting up the land into islands and mud-banks; but the majority are mere *culs-de-sac* losing themselves amid the dense vegetation in swampy depressions.

The Delta, for the most part, is made up of low-lying swampy land, intersected by ridges of uniform elevation at short distances apart. These ridges run in a direction corresponding with the coast-line, and are doubtless the remains of the old beaches. They afford the only dry

spots in this land of water, and dwellings are only possible on their summits, since the low land between is during the rainy season covered with water, and is overgrown with rank reeds and coarse grass. Along the tops of these ridges, sugar, coffee, maize, and oil seeds can be grown in very large quantities, while the valleys offer, if systematically drained, which is not impossible, extensive fields for rice cultivation.

The land immediately on the shore line is low and swampy. The island of Inhamissengo, between the Melambe and Kongoni bars, is nothing more than a huge mangrove swamp, with a few sand and mud ridges a mile from the sea. On one of these ridges a few miserable mud huts that have been misnamed a town have been built; on another the lighthouse and flagstaff. It is a region whose soil is for the most part a fetid, rotting mass of loathsomeness, from which are exhaled foul stenches and steaming miasmic vapours. Earth and sky reek with their load of malarial poisons. I have passed some of these beds of long rank reeds from which the effluvia have been so foul and penetrating that for a day or more I have been unable to retain my food. It is needless to say that this is no field for white colonisation.

The Zambezi empties itself into the sea by seven mouths. The Melambe, which has never been surveyed, is crossed by a bar of sand and mud, on which the sea breaks at all tides and conditions of weather. The bar is altogether impassable, even for boats. Its channel joins the Inhamissengo, or more properly the Mosella River, some seven miles from the sea.

The Katrina and the main stream, the East Luabo, have both impassable bars similar to that of the Melambe, so that they effectually close in their mouths from the entry of vessels.

The Inhamissengo, or Kongoni mouth as it is more generally called, was the one used by Dr. Livingstone. This mouth is connected with the main stream by three channels—the Mosella, Madredane, and Inhangurué.

The Mosella leaves the main stream some 35 miles distant from the sea, and after a few miles follows a course fairly parallel to the Zambezi. Fifteen miles from the sea it is broken up by a number of small islands, and is connected with the main stream by a small narrow channel—the Madredane. The Mosella is sometimes used by the *James Stevenson* paddle-boat belonging to the African Lakes Company, but the bar at its northern extremity is not always passable even for this light-draught craft.

The Madredane is most used for navigation, but is often so choked up with rank grass and vegetation that a passage has to be cut through it, while the grass, becoming entangled in the screw of a steamboat, often entails delay, if not serious damage. It is about 3 miles long, with a bar at its northern end. Its depth at low water is in places scarcely more than 2 or 3 feet, and its width often barely exceeds 30 yards. From the Madredane to the sea the Mosella River is named Inhamissengo. Two miles below the Madredane is the town of Conceição, founded in 1886 by Captain Castilho, the Governor-General of the Mozambique province. This settlement consists, as far as commerce is concerned, of

the Dutch House. The African Lakes Company have a wattle house here where no trade is done. They have dug a small trench by the side of the river to dock their steamers. It is convenient for that purpose, as there is a rise of from 12 to 14 feet in the tide. The *commandante militar*, the captain of the port, the director of customs and staff, the port doctor, and other representatives of the Portuguese Government are all to be found here for the purpose of looking after the single trading house, and the two vessels that as a rule are chartered by it during the year. Although by many of the Portuguese, who should have been better informed, I was considered as a British Government spy, still, with scarcely an exception, I received nothing but kindness from them, more particularly from Señor Augusto Cezo Paiva d'Andrade, whose guest I was while exploring the Chinde River, and his well-known relative, Lieut.-Colonel Joaquim Carlos Paiva d'Andrade, to both of whom I am deeply indebted for their kindness and hospitality. The site on which the Dutch house had first built their store is merely a slight elevation in the neighbouring swamps. To suit this house the Portuguese custom-house was removed to there from the mouth of the Kongoni, where it was originally established. A wharf has been made by Governor Castilho, alongside which vessels can move in $2\frac{1}{2}$ fathoms of water (low water). A telegraph-wire has been laid across the swamp to the Kongoni mouth, so that the arrival and departure of vessels can be announced at Conceição. Indeed, Captain Castilho during his term of office has by his energetic policy done more in the general interests of trade and civilisation in this part than all his predecessors. From Conceição to the sea the channel has an average depth of 3 to 4 fathoms, and presents no difficulties to navigation.

The Kongoni bar, of which I have made a survey, appears to be rapidly silting up. At low water it is barely covered by 2 feet of water, with a rise of tide H.W.F. and C. of 15 feet. Vessels drawing more than 12 feet should not enter except under the most favourable conditions. The leading marks, which were put up by the Portuguese under my directions, should be kept in a line on a bearing N^{b}W$\frac{1}{4}$W. This will lead over the bar in the deepest channel. Vessels outward bound are often obliged to wait—as there is no steam-vessel to tow them over the bar—some considerable time for a fair wind and tide. There is a land breeze in the morning, but sometimes at the time of H.W.F. and C. it will not be strong enough to permit of crossing the bar, so that another spring must be waited for in an extremely unhealthy spot. When there is any sea running outside, the bar is impassable. These natural difficulties tend very much against the development of this entrance of the Zambezi, for not only has the bar less water on it every year, but it is both changeable in depth and direction of channel, so that every vessel, unless with a pilot from shore on board—who can seldom be got to cross the bar except in the calmest of weather—crosses with very grave risk. From two to three vessels cross this bar as a rule in the twelve months, mostly chartered by the Dutch House. They are towed up to Conceição, and unload alongside the wharf.

The Quaqua or Quillimane River up to the present time has been

almost exclusively used by trade and commerce in putting the interior Zambezi and Nyassa districts in regular communication with civilised markets. From the Portuguese custom-house at Quillimane, 13 miles from the sea, produce and foreign goods have to be carried in lighters or the most primitive of dug-outs for some five days. Between the Zambezi and the furthest inland point attainable by the craft on the Quaqua is a tract of low swampy country some 6 or 8 miles across. During the rainy season this part of the journey is, if not altogether impassable, fraught with imminent risk to produce and goods in transit, as it is too much to expect that a native will be able to carry on his head a heavy, cumbersome load through two feet and more of water for such a distance without probable damage to his load. Indeed, 60 per cent. suffer loss or damage by water or exposure. This slow and primitive means of communication in a country like this offers the greatest facilities for the perpetration of the constant thefts that add considerably to the many disadvantages trade experiences in this country.

The Chinde River and bar, of which I have made the first survey, offer a solution to the greatest of the difficulties attending the development of trade in the Zambezi region of Central Africa—that of communication with the sea.

The bar of this river has a channel superior to that of Inhamissengo. There was during last rainy season three fathoms of water lowest spring tide, with a channel 500 yards broad, and with good sheltered anchorage. The soundings of H.M.S. *Stork* during this month, which is the dry season, give 7 feet lowest water, and this depth doubtless shows the minimum amount of water. With a rise of 15 to 16 feet, this will allow of the steamers used on the east coast entering the river. Supposing that any difficulty should arise to prevent crossing the bar, the coast steamer can, without difficulty or danger, anchor outside in four fathoms during nine months in the year, and can load and unload from and into lighters that should be towed out by a small steamer to be used for this purpose. We rarely have here the rollers and rough sea that obtains along the Natal coast, where this means of discharging cargo is in places always used. For the greater part of the year the sea in the Mozambique Channel is comparatively smooth, while during the rainy season, when the weather is unsettled, there is abundance of water on the bar. Should these 7 feet on the bar show the minimum, and it must be borne in mind that this has been an exceptionally dry season, so that this supposition is highly probable, with 20 to 23 feet high-water springs, this bar compares favourably with two-thirds of the river bars in the world.

The channel, called the Chinde River, connecting this mouth with the main stream of the Zambezi, has a minimum depth of two fathoms, and presents no difficulties for the navigation of suitably constructed steamers. The bar, moreover, possesses for vessels the advantage over Quillimane of being nearer the shore-line, and having good land-marks. The *Africa Pilot*, Part III., 1878, contains the following notice of this river, beyond which nothing has hitherto been definitely known even by the Portuguese themselves :—

"From the Mussello (*i.e.* Katrina) to Quillimane River is about

NE$\frac{3}{4}$E. distant 56 miles, in which are three or four openings in lat. 18° 34′ 30″ S., long. 36° 29′ E., one is large, with an island at its entrance, dividing the river into two branches. The general soundings along this part of the coast are 4 fathoms at low water 3 miles from shore, and from 6 to 9 fathoms 5 or 6 miles from shore."

On the northern shore of the entrance of the Chinde River is a conspicuous clump of palm-trees, which offers a good land-mark. To the westward of this clump are four palms standing up from the remainder, and plainly discernible for some distance out to sea. To enter over the bar, bring the most western of these four palms on a bearing N^{b}W$\frac{1}{4}$W., and this will lead in the centre of the channel. As soon as the outlying breakers are passed the channel will be easily made out.

This mouth has also two other rivers connecting it with the Zambezi —the Inhamacatiue and the Maria. Both of these join the Chinde River within 3 miles of the sea. These, I believe, are not so well suited for navigation as the Chinde River, though for boats or lighters they would probably afford a slightly shorter route to the main stream than the latter.

The tidal influence is felt the whole length of the Chinde channel, and very little alluvial matter is precipitated at the mouth. This is very greatly in favour of the supposition that this bar will not be found to be so changeable as most of the other bars of this great river. The advantages of the use of this river Chinde to the development of trade and commerce in this part of Africa are very apparent, when we consider how it has hitherto had to struggle against the difficulties attending the transit between the main stream and the ocean-going vessels. The greater part of the produce of this river is bulky, and extremely liable to damage and loss by wet and exposure. The expenses and risk of native porterage are too great to admit of the successful development of the produce of this country, and so it has up to the present time been confined to the most meagre proportions. The rich valley of the Zambezi and its tributaries is capable of enormous development, the only two things needed being, *that it should be a free river*, and have rapid and cheap means of communication with the sea. My discovery of a navigable entrance to the Zambezi, by which river craft can tranship at once into sea-going vessels, has shown this desired means of communication to be possible. The craft needed on the river at present are:—A steam-tug similar to those used at East London and the colony for crossing bars; covered lighters, and river steamers similar to those supplied by Yarrow to the Mozambique Company, and now used on the Pangani River, viz., about 50 feet long, and not more than 12 inches draught. These steamers will be found eminently suited for navigation at all seasons on the Zambezi and Shiré. They will bring produce down to the mouth, and should the coast steamer not enter the river they will tranship into the lighters, which will be towed out alongside. These craft will experience no difficulty at any part of the year, and will answer all the present exigencies of trade.

In conclusion, I have no hesitation in saying that this entrance will remove the greatest natural obstacles to trade, and will give facilities that

will tend considerably to the rapid and effectual development of the resources of the rich country drained by the Zambezi.

I must take this opportunity of mentioning the exceptional kindness I met with during my prolonged stay in the Zambezi Delta by the members of the Dutch House, more especially Mr. J. D. Schippers, their agent-in-chief. This kindly Dutch gentleman has been on many occasions the means of rendering valuable help and assistance to Englishmen on this coast, and the fact that he did more than any one for the unfortunate Captain Whybrant's expedition has never been recognised, and the thanks that should have been his were accorded another.

ON THE ACHIEVEMENTS OF SCOTSMEN DURING THE NINETEENTH CENTURY IN THE FIELDS OF GEOGRAPHICAL EXPLORATION AND RESEARCH.

A REPORT TO THE PARIS GEOGRAPHICAL INTERNATIONAL CONGRESS OF 1889.

By Arthur Silva White, F.R.S.E.,

Secretary to the Royal Scottish Geographical Society.

In compliance with the request of Count de Bizemont, on behalf of the Paris Geographical International Congress of 1889, I have the honour to report as follows on the achievements of Scotsmen during the nineteenth century in the fields of geographical exploration and research.

This record of Scottish achievements is grouped under the most convenient geographical divisions. The following are the divisions: I. Asia; II. Africa; III. North and South America and Polar Regions; IV. Australasia, Malaysia, and Polynesia; and V. General, which includes Europe and the various departments of geographical science. Under these several headings are recorded (*a*) the explorations and (*b*) the bibliographical contributions of Scotsmen, respectively. In order to avoid frequent repetitions, the names of Scotsmen, when first mentioned in connection with any one special achievement or series of achievements, are printed in capital letters. The titles of books are in italics, and the dates of their publication—first editions being given in all cases possible—follow in brackets.

ASIA.

At the beginning of the present century the continent of Asia was well known in its general outline and leading physical features. In India, active steps were initiated by the Honourable East India Company in the explorational and statistical surveys of the Peninsula, in which British officials have taken the leading part; it was there and in Central Asia that our surveyors and travellers have, for obvious reasons, con-

centrated their attention. The year 1800 saw the practical introduction of the Great Trigonometrical Survey of India by its originator, Colonel Lambton, upon the subsequent operations of which our topographical knowledge of India is based. It was only towards the close of last century that the true scientific value of trigonometrical surveys was fully appreciated; in India it raised the geography of the country into a science. Of the many distinguished officers and civilians who took part in the various surveys, or who worked on parallel lines, a large number were Scotsmen. My endeavour will be to separate, as far as possible, some of the most notable instances of the individual achievements of Scotsmen in the survey of India,[1] without detracting from the work of their colleagues, and to pass on to the more personal work of Scotsmen in India and in other parts of Asia.

To COLIN MACKENZIE, who commenced his extensive explorations in 1783, was due the introduction of Topographical Surveys based on triangulation. He surveyed (1790-94) Nellore, Guntur, and the Ceded Districts, and conducted (in 1799 and following years) the topographical survey of Mysore—covering an area of some 40,000 square miles. In 1809 he became Surveyor-General of Madras, and in 1816 he was appointed Surveyor-General of India. In these capacities he organised several independent surveys, and found a fresh outlet for his energies in the study of Indian antiquities, on which he was an authority, travelling extensively and making splendid collections. The Mackenzie MSS. are among the most valuable contributions to the history of Southern India. SIR ANDREW SCOTT WAUGH succeeded (1843) his former chief, Sir George Everest, as Superintendent of the Great Trigonometrical Survey and Surveyor-General of India. He completed Everest's project for the triangulation of the region between the Great Arc Series and Calcutta, including the North-West Provinces and Bengal, and he afterwards conceived the project of forming a gridiron of triangulation to the westward of the Great Arc Series. Sir Andrew Waugh was succeeded (1861) in the office of Superintendent of the Trigonometrical Survey by GENERAL J. T. WALKER, who completed his Great North-Western gridiron, and, from the time he was placed in charge of the Great Indus Series, carried out some highly important surveying operations. He has been a most energetic officer, and has written extensively on geographical subjects. CAPTAIN JOHN WOOD, whose name is chiefly associated with the rivers Indus and Oxus, the latter of which he traced (1838) to its source —earning the title of its discoverer—was the first European to reach the "Roof of the World," and is still a standard authority on the countries mapped by him. In 1839 he accompanied Sir Alexander Burnes to Kabul, and subsequently crossed the Hindu Kush to Kunduz, from whence he reached one of the sources of the Oxus (see *Narrative of a Journey to the Source of the Oxus*, [1841]). JOHN CRAWFURD, whom Sir Roderick Murchison distinguished as "a great

[1] I beg to express my acknowledgments in this place, of the great assistance I have derived from Mr. Clements Markham's *Memoir on the Indian Surveys* (1871 and 1878), and from the Obituary Notices in the Royal Geographical Society's *Proceedings*.

traveller, an accomplished Oriental scholar, an able administrator, a sound geographer and ethnologist, and an accurate statist," when Surveyor in the Company's military service, gave five years of useful service in the north-western provinces of India. He was transferred to Penang, and subsequently accompanied Lord Minto on the expedition to Java, where, as the British Diplomatic Agent, he spent five years, and made extensive journeys and voyages. In the course of his wanderings he amassed an immense amount of material for his philological and ethnographical works, to which I shall refer in another place. COLONEL T. G. MONTGOMERIE joined the Great Trigonometrical Survey in 1851. He carried out detailed work in Cutch and Karachi, but he will be remembered chiefly for his great achievements in the survey of Kashmir and the mountainous country extending thence to the borders of Tibet. This survey occupied ten years, and extended over an area of some 70,000 square miles of very rough and difficult country, a large portion of which was previously unknown. He explored the little-known districts of Baltistan, Ladakh, and the high plateaux near the Pangkong Lakes; he ascended several lofty peaks previously unscaled, and investigated for the first time some of the immense glaciers in the district. His survey of Kashmir was completed in 1864. Colonel Montgomerie gave much of his attention to trans-Himalayan exploration, and was probably the first to advocate the employment of *pundits*, whose services in countries which are closed to Europeans have been of such outstanding importance. Between 1870 and 1872, Montgomerie officiated as Superintendent of the Great Trigonometrical Survey. DR. THOMAS THOMSON, Assistant Surgeon of the East India Company, was another trans-Himalayan explorer of marked merit, and was the first to put into a connected form the geography, geology, and botany of the extensive and very intricate mountain regions between the plains of the Punjab and Turkistan. He will always be remembered for his remarkable journey (1847-8) from Leh northwards to the previously unscaled Kuen-lun mountains, during which he followed the Shyok river to its source at the Karakoram pass, which he was the first to tread after the Chinese pilgrim, Fa Hian. The results of his successful explorations he published in *Western Himalaya and Tibet* (1852). Botany, however, was his chief study, and his contributions to this science were considerable; his collections linked the labours of the Russian botanists in the north with those of the British in the south. He was "the first to demonstrate the true physical structure of the mountain masses of North-Western India, and to trace their water-systems, climate, and productions;" and "to Dr. Thomson we owe the abandonment of an idea long prevalent, that Tibet was an elevated plain or plateau; and with this fell also many subsidiary theories relating to the snow-line, glaciers, temperature, and climate of Central Asia. In short, from the date of Thomson's researches, rational superseded conjectural geography as regarded that vast, and still to a great extent unexplored, area."[1] In collaboration with Sir Joseph Hooker, he prepared a *Flora of British India* (1872), only the first part of which

[1] Sir Roderick Murchison.

appeared. Another naturalist and geographer of eminence was Dr. Hugh Falconer, who commenced his explorations in 1832, and collected and described some remarkable fossil remains. In 1837-8 he explored the trans-Indus portion of the Himalaya. From Kashmir he crossed the mountains to Iskado, in Baltistan, and traced the course of the Shigar, a tributary of the Indus, to the glacier which feeds it. In the course of this perilous journey he closely studied glacial phenomena, which led him to oppose the theory, then a new one, of the excavation of valleys by ice. Colonel Campbell Johnstone, who completed (1868) a sketch-map of some 400 square miles of previously unexplored country during the expedition of the Hazara Field Force, also spent some time among the glaciers and snow-mountains, and made a discovery regarding the true source of the Indus. Dr. James E. T. Aitchison, who acted as naturalist to the Afghan Delimitation Commission, has contributed valuable botanical papers, published at intervals during the last twenty-five years in the journals of the Linnæan and other Societies, in which he describes from personal observation the flora of the Punjab, the Kuram valley, the Afghan delimitation region, and other districts.

The name of Sir Alexander Burnes is one of the most prominent in the annals of early Central Asian travel. He took part in the survey of the North-West Frontier, and, in 1832, undertook his famous expedition into Central Asia, the results of which were published (1834) in his *Travels into Bokhara*—a book which gave the first impulse to the adventurous career of Arminius Vámbéry. During this journey he had, to use his own words, "retraced the greater part of the route of the Macedonians; trodden the kingdoms of Porus and Taxiles; sailed on the Hydaspes; crossed the Indian Caucasus, and resided in the celebrated city of Balkh, from which Greek monarchs, far removed from the academies of Corinth and Athens, had once disseminated amongst mankind a knowledge of the arts and sciences, of their own history and the world." In 1835, Lieutenant Burnes (who, by the way, was of the same family as that of the immortal Scottish poet) was elected an honorary member of the Royal Asiatic Society, for having "fixed with accuracy the position of Bokhara and Balkh, and the great Himalayan mountains, and having done more for the construction of a map of those countries than had been done since Alexander the Great." He had, moreover, ascertained a continuous route between Western Asia and the Caspian Sea, and was the first traveller to open the Indus to the policy of Great Britain. In 1836 he was intrusted with the mission of opening up commercial relations with Dost Mohammed, the ruler of Afghanistan, and arrived at Kabul in 1837, where, two years later, he was appointed Political Resident. But at the very commencement of the insurrection in favour of Dost Mohammed, on November 2, 1841, Burnes, his brother Charles, and seven other officers, were massacred. After his death, was published *Cabool; being a Narrative of a Journey to and Residence in that City, in the years 1836-7-8* (1842).

To the operations of the Archæological Survey of India the geographical and ethnographical sciences are largely indebted for the

identification of ancient sites and the interpretation of the landmarks of history afforded by the ancient memorials of India. For this valuable service we are mostly indebted to five Scotsmen:—COLIN MACKENZIE (S. India), whose work we have elsewhere noted, and DR. BUCHANAN HAMILTON (Bengal), who carried out explorations in Burma, Bengal, Nepal, Malabar, and Mysore—both of whom were among the earliest workers in this field of research; to JAMES FERGUSSON, who was the first to systematise and popularise Indian architecture by his admirable classification; to GENERAL CUNNINGHAM, the distinguished scholar and antiquarian, who, at the institution of the Archæological Survey of India in 1860, was selected by Lord Canning as its first Surveyor-General, and who was the author of a learned work on *The Ancient Geography of India* (1870), and was successful in identifying many important sites; and to DR. JAMES BURGESS, for his work in the Western Presidency, and the labours on which, as Superintendent of the Archæological Survey of India, he is now engaged.

SIR CHARLES MALCOLM, the first Commander-in-Chief of the Indian navy (1827-1838), instituted several extensive and important marine surveys.

DR. BUIST (1805-60), when in charge of the astronomical, magnetic, and meteorological Observatory at Bombay, made, corrected, and recorded, in the space of three and a half years, upwards of 300,000 observations. He also organised and introduced a system of tidal and meteorological observations over an area extending from Cape Comorin to the Red Sea, and originated the publication of ocean-current charts. He contributed many valuable papers to the *Transactions* of the Bombay Geographical Society, of which he was Honorary Secretary.

SIR DOUGLAS FORSYTH went on special missions (1870 and 1873) to Kashgar and Yarkand, and brought back a vast amount of geographical information. COLONEL HENRY TROTTER was the geographer in charge of the survey operations in Sir Douglas Forsyth's expedition to Eastern Turkistan and the Upper Oxus in 1873-4. SIR WILLIAM TAYLOUR THOMSON visited Khiva, and explored the country between Khiva and Persia (about 1841). DR. BELL, physician to the British Legation at Teheran, is also known for his Central Asian travels; he lost his life in Seistan, whilst travelling on the borders of Afghanistan. SIR ALEXANDER BETHUNE LYNDSAY travelled much in Persia, and commanded the army which put down the rivals to the throne on the death of Fath Ali Shah; so that he was instrumental in putting Mahomed Shah (father of the present Shah) on the throne. SIR DONALD STEWART, when commanding the army in Afghanistan, had a great amount of surveying work done. MR. GEORGE SUTHERLAND MACKENZIE, who has been recently in East Africa, organising the work of the British East Africa Company, was one of the earliest explorers between the Karún and Ispahan. The life-work of SIR R. MURDOCH SMITH is specially noteworthy. He explored some new country in South-eastern Persia and Western Baluchistan, with a view to telegraphic communications with India. He was one of the officers sent out in 1863 to Persia, to establish telegraphs in connection with the Indo-European system, and

was fully twenty years Director of the British Government Telegraphs in Persia. He also explored the topography of Caria (Asia Minor) when attached to Sir Charles Newton's expedition (1856-59). As regards the excellent surveys carried out in Palestine by the Exploration Fund, Messrs. THOMAS BLACK and GEORGE ARMSTRONG started the survey, measuring the base and closing base lines, and performing most of the triangulation and detail work; MAJOR ANDERSON and MR. JAMES MACDONALD have also rendered valuable services.

The British India Steam Navigation Company (essentially Scottish), founded, and still presided over, by SIR WILLIAM MACKINNON of Balinakill, has rendered service to geography by establishing and keeping up steam communications all round the coasts of India and the neighbouring seas. MR. A. ROSS COLQUHOUN—who, with Mr. Holt Hallett, formed the project for the connection of India and China, and the opening up of Siam and Indo-China, by railway—carried out some interesting explorations (1881-2) in Southern China and the Chinese Shan States, and in Siam and the Siamese Shan States (1883-4), during which he and Mr. Hallett succeeded in tracing out a practicable path for a railway. GENERAL W. C. MACLEOD, of the Madras Army, travelled (1837) from Moulmein through Upper Siam and the Meinam valley to Kiang-tung, a Shan State on the Upper Cambodia River, an account of which journey he published (1869) in a Blue Book: he was the first Englishman to reach those parts.

The achievements of Scotsmen in Asia appear, from the above chronicle and as far as I have been able to ascertain, to have been concentrated in our Indian Empire and the contiguous countries to the north and west. I have not noticed the journeys, in different parts of Asia, of the pioneer missionaries, many of whom from their names appear to be Scottish, on account of the insuperable difficulty of ascertaining their nationality. By their tours and scientific papers in the Transactions of learned Societies, Scottish missionaries like DR. JOHN WILSON, STEPHEN HISLOP, and DR. ROBERT HUNTER, did much for Western and Central India.

Of isolated achievements, which may conveniently be inserted here, I mention the following:—Our knowledge of Persia was advanced by the mission to Kabul in 1808-9, of MOUNTSTUART ELPHINSTONE, the author of an *Account of the Kingdom of Caubul*, etc. (1815). SIR JOHN M'NEILL, from 1831 to 1844, also revealed Persia. The EARL OF GIFFORD was distinguished for distant travel, and wandered far into the higher and little-known regions of the Himalayas. MR. A. DALGLEISH carried out some remarkable explorations in Kashgar, which he was the first European merchant to visit, and elsewhere. SIR CHARLES MACGREGOR travelled extensively in Persia, Afghanistan, and Baluchistan, and explored some entirely new country in Afghanistan and Persia. He visited and explored parts which had never before been reached by Europeans. Our present knowledge of the Andaman Islands is largely due to the wise administration of COLONEL T. CADELL, the Chief Commissioner. CAPTAIN BASIL HALL, in the first years of the present century, travelled in Java, Syria, and other parts of the world. He accompanied

Lord Amherst on his mission to Pekin (1816), when he visited some of the places on the coast of Corea which were little known to Europeans, the records of which he published in his book, *Voyage of Discovery to Corea and Loo-choo* (1818), which excited great public interest at the time, and went through several editions. The EARL OF ELGIN'S missions to China and Japan (1857-60) resulted in four new ports in China, and as many in Japan, being thrown open to Europeans. DR. W. G. DICKSON was the first European to cross China from Canton to Hankow (1861).

BIBLIOGRAPHY: ASIA.

The foregoing mentions with sufficient comment the following publications: The MACKENZIE MSS.; *Narrative of a Journey to the Source of the Oxus* (1841), by CAPTAIN WOOD, a new edition of which, with an essay on the valley of the Oxus, was published by COLONEL YULE in 1872; DR. THOMSON'S *Flora Indica;* SIR ALEXANDER BURNES' *Travels into Bokhara* (1834), and *Narrative of a Residence in Cabool* (1842); *The Ancient Geography of India* (1870), by GENERAL CUNNINGHAM; MOUNTSTUART ELPHINSTONE'S *Account of the Kingdom of Caubul* (1815); and CAPTAIN HALL'S *Corea*, etc. (1818.)

The most complete and comprehensive account of India and its people, published in 128 volumes, is to be found in the *Statistical Survey of India.* This colossal work, representing eighteen years' labour, was under the direction of SIR W. W. HUNTER, who himself condensed it, making it more available to the general public, in the fourteen volumes of his *Imperial Gazetteer of India* (1885-87). Sir William Hunter's other writings on India are both voluminous and valuable: the following may be mentioned: *The Annals of Rural Bengal* (1868), *The Indian Empire* (1881), *The Indian Mussulmans* (1871). Many important contributions have been made by COLONEL YULE. He edited, for the Hakluyt Society, *Cathay and the Way Thither* (1866), which is a collection of mediæval notices of China; he has published the *Book of Ser Marco Polo, Narrative of the Mission to the Court of Ava in 1855*; and he has written extensively on geographical subjects in the *Encyclopædia Britannica* and elsewhere. DR. GEORGE SMITH merits the distinction of having given in his *Geography of British India* (1882) the first systematic, scientific account of these countries. MR. J. W. M'CRINDLE has edited in English the early notices of India by Greek travellers and geographers. Surgeon-General E. BALFOUR'S *Cyclopædia of India* (1885) is a standard work. Of other general works, those of JOHN CRAWFURD are of special merit. The result of his philological studies at Penang were given in his remarkable *Malay Grammar and Dictionary* (1852). In 1820 he published his *History of the Indian Archipelago*, which embodied his researches during the five years he resided in Java, in the course of which he amassed an immense amount of material concerning the ethnology, natural history, and geography of the Archipelago. In 1856 he brought out his *Descriptive Dictionary of the Indian Islands and Adjacent Countries*, which was practically an amplification of the above. He also contributed thirty-eight memoirs to the *Journal*

of the Ethnological Society, of which he became President in 1861. The brothers Sir William Muir and Dr. John Muir have made learned contributions, if indirectly, to geography, the former for Early Arabia in the first edition of his *Life of Mahomet*, and the latter for Ancient Iran and India in his *Sanskrit Texts*. Sir Charles U. Aitchison, early in his career (1862), did more, perhaps, than any previous writer to lay bare the third of India which is under its own feudatory sovereigns by his seven volumes entitled *A Collection of Treaties and Sunnuds relating to India and Neighbouring Countries*, with maps, of which a second edition appeared in 1876.

Of books dealing with Indian antiquities many important ones have been contributed by Scotsmen. James Fergusson's paper to the Royal Asiatic Society on *Rock-cut Temples of India*, which was published separately in 1845, first placed the theory and uses of these monuments on a basis of certainty, and his *History of Architecture* contained the only complete account of Dravidian temples. General Cunningham systematised the itineraries of the Chinese pilgrims to the Buddhist holy places of India, and, as I have mentioned in another place, wrote with authority on antiquarian subjects. His official reports on the *Antiquities of Northern Hindostan* are of striking merit. He published in 1854 his *Ladak: physical, statistical and historical*, which gave a general view of the Western Himalayas. Dr. James Burgess, who was first engaged in the archæological survey of Western India, and is now Director-General of the Archæological Survey of India, has published, besides his official reports (Western India, 1874; Kathiawar and Kachh, 1874-5, etc.), *The Buddhist Caves and their Inscriptions* (1883), *The Caves of Elura and the other Brahmanical and Jaina Caves in Western India* (1883), *The Buddhist Stûpas of Amaravati and Jaggayyapeta described and illustrated* (1887); and thirteen other separate publications. He contributed many valuable papers to the *Indian Antiquary*, which he started and edited from 1872 to 1884. John Wilson, the famous Bombay missionary, wrote a good book on the *Cave Temples and Religious Excavations of Western India* (1875); his *Lands of the Bible* (1847) is still a text-book of authority on some parts of Syria and Western Asia.

Of the *Gazetteers* may be specially mentioned, the *Gazetteer of Central Asia*, the only trans-frontier one, edited with so much labour and such conspicuous ability by Sir Charles Macgregor, who himself compiled the first volumes describing Afghanistan and Persia, Captains W. S. Lockhart, E. Chapman, J. M. Trotter, and C. Bates contributing smaller volumes on Khiva, Khokand, Bukhara, and Kashmir. Afghanistan and Baluchistan have since then been rewritten and brought up to date by Colonel Sir W. S. Lockhart and Major Maitland, and two volumes were added (1882) by Colonel J. M. Trotter. The work, which is confidential, includes all the countries bordering our Indian frontier, and is steadily progressing.

Of the numerous books of travel, only some of which can be referred to here, the first place, in point of date, must be given to *An Account of an Embassy to the Court of the Teshoo Lama in Tibet* (1800), by Captain Turner, who, with George Bogle, was sent by Warren Hastings to the

Lama of Tibet, on which occasion he and his companion accomplished the unique feat of crossing the Eastern Himalayas from Bhutan to the valley of the Sanpo. James Baillie Fraser gave an account of his unsurpassed journey across the southern slope of the Jumna, in his *Tour through the Snowy Range of the Himalaya Mountains* (1820). His other works, equally deserving of notice, were, *Narrative of a Journey into Khorassan in the years 1821 and 1822* (1825), which included an account of the countries to the north-east of Persia, *Travels and Adventures in the Persian Provinces* (1826), and *A Winter Journey from Constantinople to Tehrán* (1838),—a journey which he performed on horseback. He also wrote a history of Persia. One of the principal books of travel in Persia is Macdonald Kinneir's *Geographical Memoir of the Persian Empire* (1813); another good book, entitled *Two Years in Persia* (1852), was written by James Binnie. Sir John Malcolm wrote what is still the standard *History of Persia* (1815). His *Sketches of the Manners and Customs of Persia* (1845) gives one of the best popular accounts of the country and its people. He went to Persia at the head of a special mission in 1800, and again in 1810. Major H. B. Lumsden's *Mission to Kandahar*, with appendices, printed confidentially by the Government of India (Calcutta, 1860), is full of information on Afghanistan and its people. Dr. Thomson, who reached the summit of the Karakoram Pass, as previously mentioned, published in 1852 his *Western Himalaya and Tibet*, in which the physical structure of the Western Himalayas was for the first time scientifically treated. The adventurous journeys of Sir Charles Macgregor are well told in his *Narrative of a Journey through the Province of Khorassan* (1879) and *Wanderings in Baluchistan* (1882). Dr. Buchanan's work on *Malabar* is still a standard authority, and Mr. William Logan's book (1887), with the same title, is also deserving of notice. A good book on Japan and its people, entitled *The Morning Land*, was written by Mr. Dixon, and Mr. Edkins has written extensively on China. Mr. J. Scott, who travelled much in Indo-China, and has written several interesting reports on the Shan States, has published *Shway Yoe: The Burman, his Life and Customs* (1882); and *Tonquin* (1885).

Dr. Roxburgh, "the father of Indian Botany," who was the first Superintendent of the Botanic Gardens at Calcutta (1793-1814), was the author of the splendid work *Flora Indica*, which was subsequently published (1820-32) in three volumes. He was the first to reduce the plants of the East to a flora. Dr. Hugh Cleghorn is the author of valuable works on the forest conservancy of India, of which he was the founder. He has published *Forests and Gardens of Southern India* (1861), and *Exploration of the Punjab Forests of the North-west Himalaya* (1864). The old Indian medical service has produced other noteworthy scholars and writers besides those already mentioned, such as Dr. Thomas Anderson, who introduced the cinchona culture from Java into Bengal. Colonel Baird Smith, an authority on the canals and rivers of India, paid some attention to the earthquakes.

The eminent hydrographer, James Horsburgh, published in the first years of the present century a variety of charts, and memoirs of his voyages, relating to Indian navigation. His still famous *East India Directory*, which

was first published in 1809, has gone through several editions under different editors; Horsburgh compiled it from original journals and observations made during a period of twenty-one years in Eastern Seas. He also edited a new edition of Mackenzie's *Treatise on Marine Surveying* (1819).

Of other works by Scottish authors, the following may be noted:—*History of the Sikhs* (1849), by CAPTAIN J. D. CUNNINGHAM; *The Abode of Snow* (1875), by ANDREW WILSON; *Across Chrysé* (1883), *Amongst the Shans* (1885), and *Burma and the Burmans*, by A. ROSS COLQUHOUN; *Voyage of the "Alceste" to Corea and Lewchew* (1818), by JOHN M'LEOD; *Mandalay to Momein* (1876), by DR. J. ANDERSON; *Wanderings in China* (1847), by ROBERT FORTUNE; *Doings in China* (1843), by LIEUTENANT ALEXANDER MURRAY; *Unbeaten Tracks in Japan* (1880), by ISABELLA L. BIRD; DR. DICKSON'S *Japan*, and his recent volume entitled *Gleanings from Japan* (1889); *The Roof of the World* (1876), by COLONEL T. E. GORDON, who took part in Forsyth's special mission to Kashgar; *Handbook of the Trade-Products of Leh* (1874), by DR. J. E. T. AITCHISON; PROFESSOR JAMES BRYCE'S *Transcaucasia and Ararat* (1877); LAURENCE OLIPHANT'S *Land of Gilead* (1880); DAVID ROSS' *Land of the Five Rivers and Sindh* (1883), a descriptive and historical account of the Punjab and Sindh; MR. A. MACKENZIE'S *North-East Frontier of Bengal* (1884), which is an admirable history of our relations with the hill-tribes and a permanent Government handbook; *Lahore to Yarkhand* (1873), by DR. GEORGE HENDERSON, who accompanied Sir Douglas Forsyth's mission as medical officer; *History of the Corea* and *The Manchus* (1880), by REV. JOHN ROSS; *Travels in Ava, Persia, and Turkey* (1830), by SIR J. E. ALEXANDER; *Travels in North China, Manchuria, and East Mongolia* (1870), by REV. A. WILLIAMSON; *The Russian Empire* (1882), by JOHN GEDDIE. DR. ROBERTSON SMITH, whose notable researches in Arabia (1879-80) were first published by the *Scotsman* newspaper, has contributed many valuable articles of a geographical character to the *Encyclopædia Britannica*, the last edition of which he edited with Professor Spencer Baynes.

AFRICA.

THE development of Continental Africa as a field for European enterprise falls almost entirely within the present century. No other continent has benefited by the labours of so many eminent Scottish explorers, the record of whose achievements is an almost continuous narrative of the modern history of African exploration. Hence, in order to give balance to this review of Scottish achievements in Africa, I have in a few instances been tempted to overstep the precise limitation of dates.[1]

The systematic scientific exploration of Africa dates from the foundation in London, in the year 1788, of the African Association. JAMES BRUCE, however, merits the distinction of having led the first great

[1] The report on Scottish achievements in Africa has been based on Dr. Supan's admirable review in *Petermann's Mitteilungen* (vi., vol. 34) entitled *Ein Jahrhundert der Afrika-Forschung*. I beg to express my acknowledgments to him in this respect.

scientific expedition, on which occasion (1768-73) he travelled from Massowah to the sources of the Blue Nile, and then through Senaar and the Nubian desert back to Egypt. Other, though less important, journeys had of course been made, but it was due to the African Association that, in place of isolated individual effort, a system of connected scientific exploration was introduced. At that time our knowledge of the continent was limited to the coastal zone which, even at the best-known parts, where missionaries and traders were settled, stretched into the Interior for about only two or three hundred miles. In Egypt and Senegambia alone were any serious efforts made in the scientific exploration of the country. The Gold and Slave Coasts were, and had been for centuries, the chief points of colonial attraction. The vast Interior was bankrupt of geographical information, except for the legacies of Edrisi and Leo Africanus, or of the Jesuits. The problem of the Niger, the solution of which had been attempted for over a century, was, for utilitarian as well as for scientific purposes, the first to engage the attention of explorers. The accounts of the fabulous wealth and power of Timbuktu exercised an unfailing attraction. Simultaneous attempts to reach this commercial centre were made by Ledyard from the Nile, by Lucas from Tripoli, and by Houghton from the Gambia. ALEXANDER GORDON LAING, who had travelled on the Sierra Leone Coast (1822) and in Tripoli (1825), was probably the first European to reach Timbuktu (1826). The first journey (1795-97) of the distinguished Scottish explorer, MUNGO PARK, through the vast unknown lands of the Niger basin, proved the existence of mountains between this river and the rivers of the West Coast, and also that the Niger, in its upper course, flowed to the east. As the agent of the African Association, Park undertook (1805) his second journey, from which he never returned. Although he himself did not solve the so-called problem of the Niger, his name and his fame are most intimately associated with the exploration of the river, and have earned for him the title of its "discoverer."

The actual solution of the Niger problem is connected with the names of CAPTAIN HUGH CLAPPERTON and his servant, Richard Lander. In company with MAJOR DIXON DENHAM and Dr. Oudney, Clapperton made (1822-24) that still famous journey from Tripoli, across the Sahara, to the Mohammedan States of the Central Sûdan. At Bornu, Denham and Clapperton separated, the former going south, the latter in company with Oudney (who died on the way) proceeding west. Clapperton and Denham returned together to England in 1825. They were the first Europeans to cross the Great Desert, to see and describe the great inland lake (Chad) of which the Arab geographers had spoken, and to bear witness to the extent and power of the Mohammedan States of the Central Sûdan. Although they were able only partly to solve the hydrographical problems of the districts through which they passed, their careful astronomical observations gave to the map of Northern Africa an accuracy it did not before possess. Clapperton's second journey (1825-27) was made at the instance of the British Government for the purpose of opening up commercial relations with the Sultan of Sokoto. His impulse to this journey was also to be looked for in the desire to explore the unknown

course of the Niger. Accompanied by three companions, who died on the way, and Richard Lander, Clapperton started for the Interior from the Bight of Benin, and, following the Niger, reached Sokoto. His death (at Changary, on April 13th, 1827) was doubtless due to the vexations and hardships of his journey, which, although falling short of its promise, was notable because for the first time the Niger and Sûdan were reached from the south. It was reserved for Richard Lander, Clapperton's faithful servant and friend, and his brother John, to prove that the Quorra, or Niger, emptied itself through several mouths into the Bight of Benin: having reached the Niger by way of Yoruba, they (in 1830) traced the river down to its confluence with the sea. This long-vexed problem was thus solved in its main features.

Before leaving the region of the Niger, in the exploration of which Scotsmen have taken such a leading part, I have to mention the distinguished services of several Scottish explorers and geographers, whose work, important though it was at the time, only subsequently bore its full fruition. Mr. Macgregor Laird, the founder of the African Steamship Company, himself an African traveller, did much to promote exploration in others. His chief merit for honourable mention in this Report, however, lies in his untiring efforts to open up communications on the Niger. With the object of attacking the Slave-Trade at its source and of introducing legitimate commerce into the heart of Africa by way of the river Niger, he (in 1854) fitted out, at his own expense, a trading and exploring expedition, which ascended the Chadda in the steamer *Pleiad* for 150 miles beyond the point previously reached. He also established trading-stations, some of which exist to this day, at the confluence of the Niger and Chadda, and at various spots lower down. Dr. W. B. Baikie, who commanded the *Pleiad* expedition above mentioned, afterwards led a Niger Expedition in 1857, and made numerous contributions to African geography and philology. Dr. E. G. Irving, during his nine years' residence on the West Coast, sent home valuable information, and did much to advance native civilisation. James Macqueen was a leading authority on the subject of the Niger. Nor should I forget the adventurous journey of Mr. W. W. Reade, who, following in the footsteps of Du Chaillu, visited some unknown districts in the Gaboon region, and subsequently led an important expedition from Sierra Leone to the Upper Niger, at Farabana, proving that the river flowed within a distance of 250 miles from Sierra Leone and was navigable from a point only 350 miles distant from the colony. In 1885 Mr. Joseph Thomson, while engaged on a commercial and political mission, explored a new route between the Niger, south of Bussa, and the towns of Wurnu, Sokoto and Gandu, in the Hausa States of the Central Sûdan; but, having had the misfortune to lose all his papers and notes, no itinerary or map of his journey has been published.[1] The journey of Mr. Joseph Thomson was the last carried out by distinguished Scottish explorers in this

[1] *Vide Scot. Geog. Mag.*, vol. ii. p. 577 *et seq.* The small map accompanying the Article was constructed by Mr. E. G. Ravenstein.

region to claim special mention here, but I am aware that this limitation excludes the praiseworthy, supplementary work of many other of his countrymen.

A new problem—that of the Nile—next engaged the attention of explorers. In 1831 the African Association was absorbed by the Royal Geographical Society of London, by whom this new hydrographical problem was energetically attacked. The question as to the sources of the Nile was practically solved by Speke and Grant. JAMES AUGUSTUS GRANT accompanied Speke on his second journey (1862), by which the outflow of the Ukerewe, or Victoria Nyanza (previously discovered by Speke), was identified as the upper course of the Nile; he subsequently served in the Intelligence Department of the Abyssinian Expedition of 1868, under Lord Napier of Magdala. Beyond that of Grant, I do not find the names of any other distinguished Scottish explorers who have contributed largely to the exploration of the Nile basin; but the name of SIR ROBERT COLQUHOUN, British Consul-General in Egypt, who rendered such conspicuous aid to Speke and Grant, is deserving of mention for his services in promoting the cause of geography. SIR COLIN SCOTT MONCRIEFF has rendered important services by the irrigation-works in Egypt under his direction.

Between 1830 and 1850 some excellent work was done, by individual explorers, in the territories of the Nile and of South Africa. From the year 1850, however, dates the chief epoch of the modern exploration of Africa. Only North-West Africa, the Nile Basin and extra-tropical South Africa had previously been attacked, but attention was next turned to the virgin lands of the Equatorial Lakes and the basins of the Congo and Zambesi, of which only incomplete or indefinite reports were possessed. Information of the existence of a great lake called "Maravi," at some distance inland from Mozambique, had been current since the year 1518. Cooley first gave the name of Nyassa to the lake. Nothing was at that time known of the sources of the Zambesi and Shiré. The Scottish colony which now exists on the Shiré Highlands and in Nyassa-land has been the exclusive creation of Scottish enterprise.

To DAVID LIVINGSTONE we are indebted for the discovery of Lake Shirwa and for our precise topographical knowledge of Lake Nyassa,[1] for the opening up of what is called the Lakes Route into Central Africa, and for the settlement of the whole region by Scottish missionaries and traders. At the head of the Zambesi Expedition, and accompanied by his countryman, DR. KIRK, and his brother Charles, Dr. Livingstone started for the Zambesi on 10th March, 1858. Under the auspices of the British Government, the expedition spent five years in Africa, and, besides leading to the important results above mentioned, succeeded in collecting a mass of valuable geographical and ethnographical

[1] As the actual discovery of Lake Nyassa is at present a subject of international dispute, I am constrained to allude in qualified terms to Dr. Livingstone's work in this connection, it being a special and legitimate request of the Congress that the Reports should avoid the introduction of all controversial statements. This remark applies also to my reference lower down regarding Lakes Moëro and Bangweolo. It is, however, an incontestable fact that to Livingstone we owe the first correct delineation of many lakes and rivers which, previous to his time, had been known only through vague or imperfect Portuguese reports.

information and in investigating the causes and results of the Slave-trade. Livingstone's journeys during 1866-73 were devoted to the solution of the Luapula problem. Ascending the Rovuma River (of which he had previous knowledge), he reached Nyassa and, in 1867, the south end of Tanganyika, the true orientation of which was due to him. He was the first European, since Monteiro (1831-32), to enter Kazembe's kingdom. On this journey he reached Lakes Moëro and (in 1868) Bangweolo: he was the first to lay down these lakes on the map approximately in their correct positions. He next discovered the head-waters of the Congo, the Luapula. In 1870, he crossed Manyema, reaching Nyangwé, on the Lualaba, the main course of the Luapula, in the following year. This was at the time when, in Great Britain, so much anxiety was felt for news of his existence. After Stanley, on his famous journey of discovery, had met Livingstone at Ujiji, the two explorers together visited the north end of Tanganyika, and found that the lake had no outflow into the Nile. Ptolemy's hypothesis was thus disposed of. In the midst of the preparations in Europe to follow up the discoveries of Livingstone in the Luapula-Lualaba hydrographic system, the great missionary pioneer died (1st May 1873) at the south end of Lake Bangweolo. To his explorations and discoveries in Equatorial South Africa I shall refer in another place.

In response to the representations of Dr. Livingstone regarding the introduction of missionary effort and commercial enterprise into the highlands of Nyassa, as being the best, or only, method to check the hateful traffic in slaves and to emancipate and elevate the native populations, the Established and Free Churches of Scotland created mission stations, and the African Lakes Company was founded (1878) in Glasgow with the object of opening up, by way of the Zambesi and Shiré Rivers and the Great Lakes, a new and almost continuous fluvial highway into the heart of Africa. A sum of money exceeding £400,000 has been thus expended in opening up and making known this portion of the continent. Of the hundred European settlers, chiefly Scotsmen, who on an average make Nyassa-land their home, many have contributed largely to our knowledge of the country of their temporary adoption. To Mr. James Stevenson of Largs, the leading spirit in the commercial development of the country, and to Mr. John Stephen, the Chairman of the African Lakes Company, we are indirectly indebted for the principal results to geography above mentioned. To Messrs. John and Frederick Moir, who have been the pioneers of the Company, we owe unstinted recognition for their explorations. And to the zealous pioneer Mr. James Stewart, C.E., we are indebted for the survey of the shores of Lake Nyassa and for our knowledge of most of the neighbouring country. The Royal Scottish Geographical Society has recently (1888) accredited as their agent Mr. Daniel J. Rankin, to whom instruments have been supplied for the exploration of some unknown districts in the Loango-Zambesi basin.[1] For the newest information concerning the

[1] Mr. Rankin informs me (April, 1889) that, owing to the disturbances in the Interior, he has been forced to abandon his expedition, for the present at least. At the same time, he announces the discovery by him of a new and navigable entrance (the Chinde River) to the river Zambesi.

country between Lakes Nyassa and Tanganyika, which are connected by the "Stevenson Road," engineered by the Company, we are almost exclusively indebted to its officers, among whom may be specially mentioned MESSRS. W. O. M'EWAN, C.E., DONALD MUNRO, and JOHN MOIR, for their careful work in the country lying immediately to the west of the Upper Nyassa. A record of this work, together with the astronomical observations by Mr. M'Ewan, and an original map by Mr. E. G. Ravenstein, were published in the *Scottish Geographical Magazine*, vol. iv. p. 415.

In Eastern Equatorial Africa, two Scottish explorers, under the auspices of the Royal Geographical Society of London, have rendered notable service. First in point of sequence, I must refer to the expedition from which its original leader, MR. KEITH JOHNSTON, never returned. Mr. Keith Johnston, who had previously experienced active field-work in unfrequented parts of Paraguay and was known as a writer on geographical subjects, left England for East Africa in November, 1878, accompanied by Mr. Joseph Thomson; shortly after his start up the river Rufiji from Dar-es-Salaam he, however, died from fever, and the command of the expedition was courageously assumed by his companion, who, although only 21 years of age, refused to turn back. MR. JOSEPH THOMSON thus explored the country between Dar-es-Salaam and the north end of Nyassa, and between this lake and the south end of Tanganyika, skirting the western shores of the latter lake up to its outlet, the river Lukuga, which had, at the time of his arrival, resumed its drainage functions. Proceeding to the west, along the banks of the Lukuga, and subsequently to the south-west, through Urua, but driven back when within a day's journey of the Congo, he reached the south end of Tanganyika, and returned to the East Coast by way of Fipa and Unyanyembe. He was the first European to see Lake Hikwa, which, owing to its numerous appellations, he re-christened Lake Leopold, after H. M. the King of the Belgians. The districts through which he passed on the above journey were thus explored and mapped for the first time, though at parts intersecting the routes of Dr. Livingstone. In 1881, Mr. Thomson explored for the late Sultan of Zanzibar some unvisited parts of the basins of the Rovuma and Lujendé. In 1883-84, as leader of the Royal Geographical Society's expedition, Mr. Thomson explored the country lying between Mombasa and the north-east corner of Victoria Nyanza. He was the first to map the northern aspect of Mount Kilima-njaro, the plateaux of Kikuyu, Kapté, and Guas-Ngishu, the mountain masses of the Aberdare Range, Mount Kenia, and the lakes Naivasha, Nakuro, and Baringo. SIR WILLIAM MACKINNON was the founder of the Imperial British East Africa Company (1888), which is essentially a Scottish enterprise, the manager of which is MR. GEORGE S. MACKENZIE. The Company has several expeditions in the field, and has already had a rough map of its territories constructed by Mr. E. G. Ravenstein. Before quitting Eastern Equatorial Africa, I think the name of SIR JOHN KIRK, the British Consul-General for so many years at Zanzibar, deserves honourable mention for his services to the numerous exploratory expeditions which set out from Zanzibar, and for his own journals and original writings.

To his individual efforts were frequently due the success of many of these expeditions.

In Tropical South Africa, Scotsmen have also made prominent discoveries during the present century. The missionary pioneer, JOHN CAMPBELL, during his journey in 1812, made known certain unexplored parts of the Orange River, and subsequently reached the sources of the Limpopo, as far as Kurichane, in about 24½° S. latitude. The 23d parallel of S. latitude, which limited our knowledge of Tropical South Africa towards the close of the fourth decade of the present century, was, in 1849, passed by DR. LIVINGSTONE, in company with MESSRS. WILLIAM OSWELL and MUNGO MURRAY, who, braving the dangers of the dreaded Kalahari Desert, which was entered from the south, discovered the Lake Ngami. From this date a new era of discovery commenced for South Africa. It began (1850) and ended (1862) with the precise delimitation of the upper and middle courses of the Zambesi and Nile rivers, the lower courses of which only had been known hitherto. As the Agent of the London Missionary Society, David Livingstone here commenced (1840) his marvellous career as a missionary and explorer, under the able guidance of DR. MOFFAT, his father-in-law, who had himself made important contributions to the geography and ethnology of South Africa. Dr. Moffat, it should be added, made journeys to the Matoppo Mountains and (1856) to the old residence of Mosili-Katse (19° 8′ S. lat.), which was one of the first expeditions into this country. During this period of his career Dr. Livingstone undertook seven journeys of not less than 600 miles each, but published no account of them. His discovery of the reported Lake Ngami had greatly aroused his enthusiasm. In 1850 he again visited the lake, and found that its overflow, the Zuga, which on his first visit he had imagined to be a considerable stream, lost itself, after only a short course, in sand and salt lagoons. In 1851 he discovered further north a mighty fluvial system (the Zambesi) of which no anticipation had hitherto existed, the chief or main artery of which native report designated as the Liambai. Two years later he ascended this river, crossed the western tributaries of the Congo in their upper courses, and (1854) reached the West Coast at Loanda. After a brief rest he set himself to the solution of the "Liambai" question. Setting his face eastwards, and following with few deviations his previous route as far as Sesheke, he discovered the magnificent fall of water on the Zambesi, which he christened the Victoria Falls, and came out (1856) on the East Coast at Quilimane. This notable journey claimed for him the distinction of having been the first European to cross the continent of Africa. But the Liambai question was still unsolved. Livingstone had no doubt that the Liambai was the upper course of the Zambesi, which earlier cartographers had made to take its rise in the Monomotapa Mountains (Matebeleland) or in the lake Mampur (Ngami). His hypothesis subsequently (about 1860) was proved to be correct, after the unknown regions of the Zambesi had been explored. Almost at about the same time, therefore, the solution of the two great hydrographic problems—the sources of the Nile and the course of the Zambesi—were achieved. More recently, MR. F. S. ARNOT has returned home to disclose his exten-

sive travels in South Africa. He has made known the Garenganzé (Katanga) country, and has helped to unravel the hydrographic problems in the country where the Lualaba, Lufira, and Zambesi rivers take their rise, a district which he has identified with Livingstone's "three fountains;" and he has apparently proved that Livingstone's "Leeba" is the Zambesi itself and not the river which flows out of Lake Dilolo. Before leaving this region, I have to chronicle the journeys of some minor Scottish explorers whose work, although insignificant beside that of Livingstone's, filled in some blank spaces on the map of Tropical South Africa. In 1826, Sir James E. Alexander revealed the country and native races from the Cape to Walfisch Bay. He led (1836-37) the first scientific expedition into Namaqua and Damará Land, north of the Orange River. Dr. Moffat's son, Mr. Robert Moffat, a government surveyor, made extensive explorations (1854-56) in Namaqualand and along the Orange River. Mr. Montagu Kerr's intrepid journey (1884) established the connection between Mauch's northernmost point and the Zambesi.

As regards the remaining portions of Africa in which Scotsmen have carried out notable explorations, I do not find any more important than the recent (1888) travels of Mr. Joseph Thomson, in the south-eastern extension of the Atlas Mountains. He was successful in exploring the lower ranges near Demnat, and, following in the footsteps of Foucauld, whose work he supplemented, he crossed the main range to Teluet. At four places, where he made ascents of the mountains, reaching on two occasions over 13,000 ft., or 2000 ft. higher than any of his predecessors, he struck new ground. Mr. Thomson, on his return, crossed the mountains into Sus, on which journey he formulated the opinion that the Atlas Mountains proper end some 20 miles from the Atlantic. The result of his explorations, which have been mapped,[1] has been to supply new and reliable data of the configuration and physical features of the Atlas range.

Considerations of space, if not of proportion, prevent my alluding to the supplementary, and, in many cases, valuable services in the field of African geography rendered by numerous Scottish missionaries, philanthropists, traders, travellers, and others, whose work or whose interests have been associated with the modern evolution of African civilisation. Yet, the distinguished services of Sir Lambert Playfair in Algeria and Tunis, the life long labours of missionaries like Mr. Hope Waddell, at Old Calabar, of Mr. John Mackenzie in Bechuanaland, or of Mr. Mackay in Buganda, are deserving of a lasting record. If other names, not coming under the above category, have been passed over in this brief report, it has not been from any want of appreciation on my part, but either from my own ignorance or from the difficulty I have throughout experienced in identifying the nationality of the numerous and notable band of British-born men whose works and writings have in so great a measure contributed to our present knowledge of the continent of Africa.

BIBLIOGRAPHY: AFRICA.

The books on Africa by Scottish authors are mostly from the pens of her explorers. Some exceptions may be noted. Keith Johnston, Junior,

[1] *Vide Proceedings* R. G. S., 1889.

contributed the volume on *Africa* to Stanford's admirable "Compendium of Modern Geography"; SIR JOHN DRUMMOND HAY'S *Morocco and the Moors* (*1839*), was published in 1861, and goes beyond the author's own travels; JOHN MACKENZIE'S *Austral Africa* (1887), although written for a political purpose, records the author's lengthy experiences in Bechuanaland and Cape Colony. Of minor books may be mentioned *Missionary Labours and Scenes in South Africa*, by REV. ROBERT MOFFAT (1842); *The Lake Regions of Africa* (1883), an admirable record of modern discovery in those regions, by JOHN GEDDIE; and BUCHANAN'S *Shiré Highlands* (1885), which deserves to be better known. An impulse was given to the cause of African exploration by Sir Walter Scott's friend, the Orientalist and Scottish poet, DR. LEYDEN, when, in 1799, he published at Edinburgh a *Historical and Philosophical Sketch of Northern and Western Africa* up to that date—a work brought down to 1817 by HUGH MURRAY. In 1879 DR. JAMES STEWART, who had been Livingstone's companion, published the account of his second circumnavigation of Lake Nyassa, and also a narrative of a journey along part of its western shore, in 1878, by DR. ROBERT LAWS, who has since continued to explore the country.

Of books giving an account of the various explorations by travellers whose journeys have already been referred to in the foregoing, we have—the following three works by DAVID LIVINGSTONE: *Missionary Travels and Researches in South Africa* (1857), *Narrative of an Expedition to the Zambesi* (1858-64), and the *Last Journals in Central Africa* (*1865-73*), which were published in 1874; *Travels to* [*Abyssinia and*] *Source of the* [*Blue*] *Nile, 1768-73*, by JAMES BRUCE (published 1804-5); MUNGO PARK'S *Travels in the Interior of Africa, 1795 and 1805* (1816); *Travels in Northern Central Africa* (*1822-24*), by MAJOR DIXON DENHAM (1826-29); *A Walk across Africa* (1864) by COLONEL GRANT, who, it may be added, contributed to vol. xxix of the *Transactions* of the Linnæan Society, 136 illustrations of entirely new plants collected by him on his journey; *Travels in South Africa, 1812-13 and 1819*, by REV. JOHN CAMPBELL (1815-22); *Travels in the Footsteps of Bruce* (1877), by COLONEL (now Sir Lambert) PLAYFAIR, who has written considerably on Algeria, our knowledge of which country he has advanced; SIR JAMES E. ALEXANDER'S *Expedition of Discovery into the Interior of Africa* (1838), giving an account of his travels north of the Orange River; *The Far Interior* (1886), by W. MONTAGU KERR; MR. JOSEPH THOMSON'S three books—*Through Masai-Land* (1885); *To the Central African Lakes and Back* (1881); and *Travels in the Atlas and Southern Morocco* (1889). To these may be added —*Narrative of an Expedition into the Interior of Africa*, by MACGREGOR LAIRD and R. A. K. OLDFIELD; *The First Ascent of the Kasaï* (1889), by CHARLES L. BATEMAN; *Travels in Western Africa*, by JOHN DUNCAN; *Report of the Expedition for Exploring Central Africa*, by SIR ANDREW SMITH; and PROFESSOR DRUMMOND'S *Tropical Africa* (1888). GENERAL SIR R. MURDOCH SMITH, who explored the Cyrenaica, in North Africa, and sent many Greek statues, etc., to the British Museum, which he discovered at the ruins of Cyrene, published in 1864 his *History of the Recent Discoveries at Cyrene*. PROFESSOR BAYLEY BALFOUR'S *Botany of Socotra* is a magnificent monograph, published (1888) by the Royal Society of Edinburgh.

(*To be continued.*)

GEOGRAPHICAL NOTES.

EUROPE.

The Geographical International Congress assembled at Paris on the 5th August, and held sittings on each successive day till the 10th August. We hope to publish an account of the deliberations of the Congress in a subsequent number of the Magazine. Our Society is represented at the Congress as a *membre donateur*, and has sent in its Report on Scottish Achievements, the first part of which we publish this month; Mr. Silva White is the Reporter. The Royal Geographical Society of London appointed as delegates Mr. Francis Galton, Vice-President, Major-General Sir Frederick Goldsmid, Vice-President, Admiral Sir Erasmus Ommaney, Mr. Clements Markham, and Mr. Delmar Morgan; Mr. Scott Keltie is the Reporter for the Society, and his Report on English Achievements is to be published at Christmas as a *Supplementary* volume. The Manchester Geographical Society was also represented at the Congress.

A Geographical International Institute was opened at Paris on 24th July. M. D. Kaltbrunner is the founder. The Institute comprises (1) a reading-room; (2) a permanent exhibition of instruments and apparatus, camp equipage, etc., used by explorers; and (3) a preparatory school for travellers, where free instruction is to be given by specialists (explorers, topographers, botanists, geologists, etc.). M. Kaltbrunner himself proposes to deliver in the principal towns of France or elsewhere lectures on "the Art of Travel," the profits by which are to go to form the nucleus of a "fund for the encouragement of explorers."

New Geological Map of France.—The great chart of France, showing the geological formations of the country on a scale of 1-500,000th has at length been completed, and a copy deposited with the Academy of Sciences at Paris. It is over fifty years since MM. Dufrenoy and Elie de Beaumont published a geological map of France on the same scale, and since that period the rocks of the different provinces have been more intimately studied. In 1882 the new general map was begun under the superintendence of the Commandant Prudent, and published by the Depôt of Fortifications. It has just been finished, and is an example of the most accurate cartography. Local geologists have contributed to the work as well as the Government surveyors, and the scale of 1-500,000th has been adopted in deference to the wish expressed at the Geological Congress of Bologna in 1881, so that different countries can more easily compare the map with their own. The scale of colours recommended at that Congress has also been followed—that is to say, the Sedimentary series is represented by the colours of the spectrum in their regular order. Thus the Trias is coloured violet, the Jurassic blue, the Cretaceous green, and the Tertiary yellow. Each of these general colours is subdivided into shades, which are deeper according as the rocks are more ancient. This is the first time the method has been employed on a large work, and it has given every satisfaction, since it allows the systems of rocks and their different gradations to be readily recognised. The eruptive rocks have been coloured in different shades of red, and the crystalline schists in carmine. As for the Primary rocks, on which the Congress came to no decision, the authors of the map have been guided by the same principles in choosing their tints. The Silurian has therefore been coloured a flesh pink, and the Devonian a red brown. The Carboniferous, according to old habit, has been coloured black and deep grey, while the Permian is represented by a yellowish grey. No fewer than 50 shades are employed; but all are easy to distinguish.

They are obtained by superposition, or difference of intensity, by means of thirteen primitive colours. The entire chart consists of 48 sheets, and it is expected to prove very useful to the nation from an industrial point of view.—*Times, 9th July* 1889.

Population of Switzerland.—On 1st December 1888, the resident population of Switzerland was 2,920,731, and the total population 2,934,027. Males numbered 1,427,377, and females, 1,506,650. Those speaking German amounted to 2,092,530; French, 637,972; Italian, 156,606; Romanche, 38,305; and various, 8574. There were 1,724,957 Protestants; 1,190,008 Roman Catholics; 8386 Jews: and of various or no religions, 10,706. The returns for the chief towns were—Bâle, 70,386; Geneva, 52,457; Berne, 45,966; Zurich, 27,632.

ASIA.

Asiatic Russia.—Our Honorary Corresponding Member, M. Vénukoff, writes to us :—"M. Grum-Grjimaïlo has commenced his voyage in Central Asia, starting from Vernoï. His first letter, dated from Jarkent, on the Russo-Chinese frontier in Dzungaria, appeared in the Russian journal *Novosti* for 6th July 1889. It informs us that the season of Spring was this year late in Dzungaria and that the lower limit of snows on the Ala Tau mountains reached in the month of May to an elevation above the sea-level of 2400 mètres (7874 ft.), which was very low for that season of the year in the lat. of 43° N., and under the brilliant sky of Central Asia. The Ili and all other rivers of the region were greatly increased by the melting of the snows in June. M. Grum-Grjimaïlo will continue his journey in the Chinese provinces adjoining the Thian Shan, but it is expected that the Chinese authorities will place obstacles in his way, from the fact of his being unprovided with a passport from the Tsung-li-yamen of Pekin. But if he succeeds he will establish a precedent for all future explorers. I should add that, quite recently, Jarkent has suffered greatly from a violent earthquake, but it appears that this occurred after M. Grjimaïlo's departure.

"Colonel Pevtzov reached Yarkhand towards the end of May. At about the same time, Captain Grombtchevsky was on the Pamir, in the neighbourhood of Daraout-Kourgan, from whence he was to have made his way to Chougnan, but the latter country having been again occupied by the Afghans, I do not know whether the explorer will venture to enter it."

M. Vénukoff also sends us a copy of the ethnographical map prepared by him in 1883, and now brought up to date, showing the distribution of the populations in the interesting and important district of Vladivostok. The region represented is, roughly, bounded on the west by Manchuria, on the north by latitude 45° N., and a little beyond, on the east by longitude 135° E., and on the south by the sea. Within this territory, there was, in 1888, a population numbering 55,600, of whom 35,000 were Russians, 10,000 Coreans, 9500 Chinese, 500 Japanese, 500 Goldis and Orotchis, and 100 Europeans. Among the Chinese there were nearly 1000 nomads; the Goldis and Orotchis are also nearly all nomads (hunters and fishers). The Europeans and the Japanese inhabit Vladivostok. The Coreans are all sedentary, and they inhabit the large villages; whilst the Chinese are dispersed about the country, noticeably in communities (farms) settled along the eastern river-courses. The principal centre of population is of course Vladivostok (13,000 inhabitants); then come Nicolskoé, Novo-Kief, and Kamén-Rybolov. There are in the Russian villages 9 *stanitzas* occupied by 2877 Cossacks, whose duty it is to guard the frontier between Lake Hankaï and the mouth of the Toumen-oula.

Bay of Bengal and the Coasts of India.—We have received Commander Carpenter's *Administration Report* of the Marine Survey of India for 1888-89. From it we abstract the following.

At the date of last report, the *Investigator*, having completed the outlying dangers on the west coast of the Andaman group, was preparing for her return trip to Bombay. Leaving Port Blair on the 11th April a few hauls of the trawl were made in the vicinity of the group; and then a north and south line of deep soundings was carried, about 100 miles west of the Andamans and Nicobars, from lat. 12° 40′ N. to lat. 5° 45′ N. In the latter position a submarine elevation was found of 1370 fathoms standing on a plateau of about 1700 fathoms, which difference represents a submerged peak 2000 feet high. Several hauls of the trawl were made, the deepest being in 1924 fathoms, the capture at that depth being confined to a few star-fish and a holothurian. On the 23d April a series of temperatures was taken by deep-sea thermometers down to 250 fathoms in lat. 6° 7′ N., long. 85° 11′ E.

On the 20th October the *Investigator* left Bombay Harbour. She took a few further soundings between the Northern Lakadivh banks and the bank off the West Coast of India, which confirmed the opinion derived from last year's soundings, viz., that the Lakadivh group form a chain of peaks rising from a bed of 1100 fathoms, or are in themselves 6600 feet above the bottom, a height somewhat similar to that of the Western Ghâts in those latitudes. It was found that the position of Little Andaman had to be moved about 1½ miles to the eastward.

A course was now shaped for False Point, Orissa; and deep soundings were again taken on the passage across the Bay. From the map attached to the Report, it is seen that the bed of the Bay of Bengal has a regular decline towards its mouth; that the Andaman and Nicobar range forms its eastern boundary (the sea east of the Andamans being a separate basin); that there is slightly deeper water nearer the coasts than in the centre; and that the depth falls very suddenly from the 100-fathom line off the Sunderbunds to the 900-fathom line. The most rapid fall is really from 100 fathoms (the Continental Shelf) to 650 fathoms, where the slope is 1 in 13,—a considerable slope for soft mud.

If we take the slope of the bed of the Bay between the 1100 and 1400 fathom contours as being the true gradient of its fall, unaffected to any great extent by the detritus from the rivers, and carry this gradient (which is only 1 in 396) northward, we find that it brings the bed of the Bay up on a level with its surface only when it reaches the foot of the Himalayas. A few more deep soundings are still required on the west side of the bay to finish the contours accurately.

The mouth of the Chilka Lake was found to be useless for trade, being extremely shallow, with no passage between the breakers. The connection between the lake and the sea is by a long narrow arm of sand 20 miles in length, running parallel with the shore, and it is probable that there is an ebb and flow through the sandy arm which diminishes the volume of water passing through the actual entrance or break in the line of coast. The long sandy spit is a feature of most of the rivers debouching on this coast, and it is an interesting fact that several of the river-mouths, viz., False Point, the Jotador River, the Devi River, and the Chilka Lake entrance, have all shifted their positions about three miles to the north-eastward in the last forty years by the extension of their sandy spits to that amount. The active cause of the growth of these spits is the surf formed by the continuous southerly swell, which, impinging on the ebbing river waters, forces the latter to escape in a north-easterly direction, the spits

being gradually increased by the accumulation of river detritus and of coast-drifted sand unable to escape seaward. The currents, which appear to be entirely caused by the wind and not due to tide, set towards the coast, and, a few miles off shore, are strong.

At Gopalpur there is at times a remarkable line of phosphorescent water two miles off the coast which has the appearance of breakers. The light streams up from below, and a bucket and line lowered into it can be followed by the eye nearly to the bottom. The origin was not discovered, but as it occurs just at the junction of the green shore water and the blue ocean water, it is possible that there is some chemical action which excites the luminous secretions of the innumerable minute organisms that abound there. It was noticed that a small medusa that had not before shown signs of luminosity was so bright along each ray that its phosphorescence could be seen by daylight.

Observations for temperature were taken on a line out from 40 to 300 fathoms which show that there is no "wall" of cold water off this coast.

Comparing the present depths in Coconada Bay with those found by the Marine Survey in 1882, a northerly movement of the estuary is again seen; for both at Godávari Point and at the anchorage the banks have moved half-a-mile to the northward in seven years, or at the rate of three miles in forty-two years. This should be thoroughly understood at Coconada, as it is apparent that in another forty years the settlement will be unapproachable by water.

The erosion, or transfer of sand, by the continuous southerly swell and by the predominant southerly wind, has only to be seen for an observer to understand what vast changes must occur along the immediate sea-board. By trapping the sand with cuasarina plantations, by checking and raising sand-dunes by means of hurdles, and by restraining the main flow of the river from following small and useless creeks, much may be done to improve the navigation and habitableness of such deltas as that of the Godávari; but it is hopeless to do more than endeavour to guide these elusive forces: it is impossible to arrest their progress.

The appendices to the Report include a table showing the deep soundings, the report of the Surgeon-Naturalist, and a memorandum by Commander Carpenter regarding the unsurveyed condition of certain portions of the coast-line of India and Burma.

AFRICA.

The **Afrikanische Gesellschaft** in Germany, after fifteen years' fruitful labour, has been dissolved. Its functions are now practically undertaken by the State. *Petermann's Mitteilungen* (Heft 8, 1889), points out some of the work the Association has initiated: the first exact information in regard to the Loango coast, Dr. Lenz's work on the Ogowé, the admirable work in the southern Congo basin of Pogge, Schütt, Buchner, Wissmann, Kund, Tappenbeck, Wolf, and Buttner, Dr. Lenz's journey across the Sahara, Flegel's exploration of the Benué and his advance southwards, Rohlfs' Kufra journey, Rohlfs' and Stecker's work in Abyssinia, the work of Dr. Kaiser in East Africa, and Böhm's and Reichard's exploration of the territory between the Luapula and Lualaba. The last volume of the Society's *Mitteilungen*, a valuable publication, illustrated by excellent original maps, has been received by us. The Association has shown how much can be done by private individuals to initiate explorational work which, if moderately successful, is afterwards taken up by the State.

Gold Coast.—Captain von François made, between January and April 1889, a new expedition to Salaga by way of Kpandu and Kratji, and, after a flying visit

to the Volta, returned to the coast. He was able to complete or confirm several of his former observations.[1] The height of the Adaklu, which Dr. Henrici put at 3000 *m.*, Captain von François finds to be only 820 *m.* (2690 feet). From the station of Bismarckburg, Dr. Wolf last January conducted a punitory expedition to Kebu, in the south, in order to protect the caravan traffic with the coast. Kebu is a well-watered, mountainous country, suitable for plantations or cattle grazing.—*Petermann's Mitt.*, 8, 1889, and *Mitt. aus deutschen Schutzgeb.*, 1889, p. 33.

Equatorial Territories.—Dr. Zintgraff's expedition to Adamawa, from the Barombi station to Ibi on the Benué, between December 1888 and June 1889, is, according to telegraphic information, successfully concluded. His companion, Captain Zeuner, last January paid a short visit to Bioko, an important point on the upper Massake previously reached by Dr. Zintgraff. A further extension of their explorations to the N. or NE. was rendered impracticable by native troubles. The results of Captain Zeuner's and Count Bernstoff's journeys on the Akwa-Jafe, the Rio del Rey, the Ndian and connecting streams, and on the Massake and Meme, supply material for a new map of the Anglo-German frontier territory which differs considerably from that of the old maps.

Both Captain Zeuner and Captain Kund have returned to Europe for a brief rest. After his first fruitless attempt to found a station on the upper Sannaga, Kund made another journey at the close of last year, and founded a station between the Sannaga and the upper Njong, which was placed under Lieutenant Tappenbeck, whose recent death from fever we regret to notice.—*Mitt. aus deutschen Schutzgeb.*, 1889, pp. 38, 61.

Exploration of the Lomami.—M. Alexandre Delcommune having explored, on board the steamer *Roi des Belges*, this important waterway, the upper course of which Cameron and Wissmann had already traversed, has shown that it is not, as was supposed, an affluent of the Sankuru, but a distinct river which is identical with the great tributary that the Congo receives a little below the Falls, the lower course of which Grenfell examined in 1884. For seventeen days, and for a distance of over 570 miles, he ascended the Lomami, which he found to have a mean width of about 270 yards, a depth of 10 feet to 16 feet, a current running 2½ to 3 miles an hour, and easy to navigate. At the spot where he ceased his explorations (about lat. 4° S.) he was only three days' march from Nyangwé; above, the river continued to be open and free. With the Kassaï and Mobangi, the Lomami promises to take rank as one of the chief tributaries of the Congo. Running north and south parallel with the Congo, which it joins *below* the Falls Station, it offers an uninterrupted fluvial highway to within three days' march of Nyangwé. Its importance in the development of the Independent State is therefore evident.

Madagascar.—The Norwegian missionary, J. Nielsen-Lund, has carried out an important journey in Madagascar, which, although performed in the latter part of 1887, only recently appears to have been made public (*Antananarivo Annual*, 1888, p. 440). He is the first European who has crossed southern Madagascar. He passed through Bara-land by a new route, navigated the Onilaky, the upper course of the St. Augusta River, as far as the Tanosy province, through which he struck in an easterly direction. He then marched south and crossed an uninhabited and little-watered wilderness, and emerged on well-populated districts. Contrary to former ideas, the southern, and formerly unknown, part of the island

[1] *Scottish Geographical Magazine*, vol. v. p. 43.

is not a wide plain, dotted by isolated hills, but a mountainous country with elevations of over 4000 feet. The explorer emerged from the unknown at Fort Dauphin; his return north was made by way of the coast.—*Petermann's Mitt.* 8, 1889.

New Cable: Mozambique to Mauritius via Madagascar.—After having taken soundings in the Mozambique Channel, where a mean depth of about 1090 fathoms was ascertained, the *Great Northern*, of the Eastern and South Cables Company, made similar observations off Majunga, in Madagascar, with the object of connecting by cable that place with Mozambique. From Majunga a land line is to be established to Tamatave, passing Antananarivo. This telegraphic communication is to be extended to the islands of Réunion and Mauritius, and is to be named the Mozambique-Mauritius Cable.—*L'Afrique*, August 1889.

AMERICA.

The Inland Ice of Greenland.—In regard to this subject, Dr. Fridtjof Nansen makes the following additional remarks, which were received too late for insertion at the end of his paper published by us last month :—

"When such immense quantities of ice and snow as those in Greenland are in constant movement, it is evident that the pressure must give rise to a quite enormous friction, and in this way a considerable warmth must be produced. There is thus much reason to conclude that the deeper we come in the ice the higher temperature we will find, and at a certain depth the temperature of the ice must be about its melting-point, which consequently is somewhat lower than the ordinary freezing-point (*i.e.* zero of Centigrade). Even if we do not think of the fact that the temperature of the earth's crust rises everywhere when we penetrate towards the depth, it seems thus to be likely that in the depths of the Inland Ice of Greenland, especially where the ice touches the ground underneath, there is a considerable melting going on. It may be objected that nobody has observed this melting or even a rising of the temperature of the ice downwards. This is quite true, but a good proof that a melting really goes on in the interior are the rivers, which, even in the middle of the cold Greenland winter, run out under the glaciers at the margin of the Inland Ice. I have observed such rivers myself; they were even large where there was no possibility of a melting on the surface of the Inland Ice.

"For glacialists I think the observations made on this expedition must be of great interest. I think they must contribute largely to confirm many of the glacial theories. The careful observation of a snow and ice covering like that of Greenland is, in my opinion, of great importance for the theory of the formation of valleys and fjords by the ice. The ability to excavate the ground underneath must be considerable in quantities of ice like those observed there. To me it seems, indeed, natural that the more we study Greenland, its coasts, and its Inland Ice, the more convinced must we feel of the great ability of the ice to form fjords and valleys to a great extent. Indeed, if we attentively study on one hand the fjords and valleys of Greenland, with their many evidences of glacial influence, and on the other hand the Inland Ice, we can be in no doubt whatever that these are in a near relation to each other; and if from Greenland we turn our eyes to Norway and Scotland, we must grant that there are here quite similar formations.

"In meteorological respects there are some observations of great interest. The very low temperature met with in the interior will be astonishing to most meteorologists; it does not seem to agree with the received meteorological laws—

at all events not at the first glance. The radiation of warmth from this immense snow-field, in such an altitude where the air is consequently very thin, must evidently have a great influence in lowering the temperature. The interior of Greenland must indeed be the coldest place on earth hitherto known; it must be a kind of cold pole from which the winds blow towards the coasts and the sea.

"I think that this low temperature may throw a good deal of light on the much discussed question, the cause of the great cold of the glacial period in Europe and North America, which at that time were covered with an ice-sheet similar to that we now see in Greenland. I think that the best way of solving the problems of the Great Ice Age is to go and examine the places where similar conditions are now found, and no better place can be found than Greenland. But Greenland is a vast region; our expedition was the first to cross it, but I hope it will not be the last."

Northern Mexico.—In the early part of this year, Frederick Schwatka conducted on behalf of the journal *America* an expedition into Mexico. To the issue of this paper for 25th July he contributes a brief account of his explorations, from which we glean the following.

He and a friend, who accompanied the expedition as artist, left the United States in the latter part of February. Helpers were added or discharged as circumstances determined; at no time did the party exceed sixteen persons and 47 riding and pack mules. The Santa Fé Railway was taken from Chicago to Deming, New Mexico, where the party fitted out for a trip into Western Chihuahua and possibly Eastern Sonora. This part of Mexico had been held for years by the most warlike bands of the Apache Indians, especially the Chiricahuas, and practically little or nothing was known regarding it. It was supposed to contain ancient ruins of the most extensive character, to explore which was the main object of the expedition.

On 6th March the expedition crossed the United States-Mexican boundary at Los Palomas, Chihuahua, and recrossed it on 31st May at El Paso, Tex., for the last time, being thus 86 days engaged on the trip.

The expedition claims to have been the first to call general attention to the richness and fertility of NW. Chihuahua along the eastern foothills of the Sierra Madre range. Innumerable ruins and tumuli were seen: "mound after mound in the valleys were passed, while every five or six miles a cluster of them showed a village, and every three or four times as far, enough of them to say there was a town, or even a city, that had once known Toltec or Aztec living people." The hillsides were terraced for miles up and down some of the valleys, the lower terraces of such peculiar build that they may have been used for irrigating ditches. In some places were ancient roads leading directly up very steep hills, and conducting to either a sort of fort or some spur of a hill which may have been a sacrificial altar. Lieut. Schwatka saw enough to convince him that the ancient inhabitants must have been an agricultural people in the main; their fortifications appear to have been for defensive purposes only.

The expedition called attention to the vast mineral wealth of Mexico near the U. S. boundary. Lieut. Schwatka states "there are probably 2000 [silver] mines there, which a railway through the country would allow to work at great profit, that are known to exist, but are not worked."

The most remarkable result of the expedition was, however, the discovery in the south-western part of the State of Chihuahua of living cliff- and cave-dwellers by the hundreds, and of hearing of them by the thousands. Lieut. Schwatka

thinks that they "are probably of the same tribe known as Tarahumari. . . . When surprised, these wild men of the mountains fly to their homes in the cliffs or caves at a rate of speed that defies pursuit. They reach the former by notched sticks which make ladders, should the rocky walls be too precipitous for climbing. They are unusually black-skinned for Indians, but in this respect do not differ noticeably from the so-called civilised Tarahumaris. They are tall, lean, and very muscular, their muscles not at all large, seeming to be more like bundles of sinews than like fleshy muscles." These strange people are worshippers of the sun; they expose a new-born child, the first day of its birth, to the full effects of the sun. They are extraordinarily swift of foot and enduring, and are said to be able to run down deer by following their trail for two or three days.

AUSTRALASIA.

New Guinea.—The *Nachrichten über Kaiser Wilhelms-Land und den Bismarck-Archipel* record an expedition from Constantinhafen to the Finisterre Mountains, which by following up the course of a mountain stream—apparently the upper waters of the Kabenau River—reached a point some forty miles (as the crow flies) from the coast. Here from the top of a ridge about 7580 feet above the sea, the view, though extensive, embraced only similarly steep and densely wooded ranges. The natives were timid, but friendly.

The country inland from Hatzfeldthafen, to the NW., is more promising, the valleys are wider, and the sides of the undulating hills are dotted, as far as the eye can reach, with patches of cultivation, while open tracts of grass[1] alternate with the forest. The inhabitants of this part seem less isolated from each other than usual, and there is a good deal of trade between the villages. These indeed, when inhabited by people speaking the same language, seem to form little federations, meeting for festal or business purposes. As a rule the villages in German New Guinea seem to be small, the average-sized village containing not more than eight or ten huts. Here and there they are much larger; one or two on the Augusta River appeared to contain about a thousand inhabitants.

The rainy and dry seasons differ considerably in different places. Thus at Constantinhafen last year there was severe drought from June to August, producing a plague of caterpillars, and the consequent scarcity and badness of food, causing dysentery, led to war between the villages—the theory being that the disease was induced by sorcery.[2] About Hatzfeldthafen the drought came in September and October, causing extensive forest fires, while in December the country was so flooded that channels had to be cut to drain the plantations. The meteorological conditions of the region are discussed in a paper of much interest, dealing with the country generally, by the late Administrator, Freiherr von Schleinitz (*Nachrichten*, Heft 2, 1889). The coasts of the German territory

[1] These grass-lands occur chiefly in the northern parts of the colony, and rarely above 3000 feet. The grass which occurs most commonly is the *Imperata arundinacea*, the *alang-alang* of the Malay Archipelago, which usually springs up on abandoned clearings, choking everything else. It can only be eaten by cattle when quite young—a stage at which the sugar-cane also makes valuable fodder. Unfortunately these grass tracts contain only a small proportion of useful fodder or meadow plants, and can therefore hardly be made available for pasture except by constantly burning or mowing down the *alang-alang*; the few nutritious grasses that are found, of the species of *Andropogon*, *Panicum*, *Paspalum*, and *Anthisteria*, only occur in limited quantities.

[2] Curious instances of this phase of superstition are given by Mr. Romilly in the work reviewed in our last Number.

are, he points out, within the limits of the SE. Trade-wind. This for nearly eight months of the year—*i.e.* from March or April to October—is the prevailing wind, but when the sun passes to the southward, heating up the torrid plains of Australia, the wind draws round to the NW. New Guinea has a relatively low temperature owing to its greater height, and probably to its dense forest covering. Each of the above winds come laden with considerable moisture, but the time and character of its discharge vary with the character of the land where it first reaches it, the discharge being much more violent and copious when it strikes abruptly on high mountains, or at right angles to the land, than when it first passes obliquely over a level tract. The writer pronounces the navigation of the German coast to be free from serious difficulties. There are no hurricanes; the currents, except occasionally between islands, are never strong, and only set along the coast. The tides, too, are not strong, the average rise being only about four feet; the reefs, which are few, are known, and the high lands from which they proceed can be seen in time, even at night. About the west end of New Britain, however, and around Rook Island, there are dangerous reefs in every direction. The writer strongly recommends this as the best and most direct route from eastern Asia to the eastern or southern parts of Australia, and it will be remembered that Captain Moresby urged the advantages of this route, when it was far less known than at present. The character of the coast lying between Cape Cretin to the S. and Hatzfeldthafen in the N. is described with greater detail than hitherto; the general appearance of the islands, too,—Rook, Tupinier, Lottin, Long, Crown, Rich, and Vulkan Islands—is given. All of these, except Rook Island, are volcanoes, either active or only recently extinct. Rook Island is evidently volcanic by origin, but no one of its hills can be definitely pronounced to be a crater.

Except at very few points, the interior is still as little known as ever, but it seems clear that there is a good deal of land available for culture; either there is a narrow strip of fertile land between the cliffs and the sea, which has the advantage of being raised some yards above sea-level, so that it is rarely submerged, or, where the high mountains recede further from the shore, the intermediate space consists of rolling hills, available for plantations. There are also considerable deltaic tracts at the mouths of the rivers. Often, instead of a river mouth, there is a barrier formed of the fluviatile deposits heaped back by the waves, through which a portion of the stream percolates imperceptibly. This barrier is overgrown by trees and luxuriant vegetation; behind it usually is a swamp, and beyond this again a tract of fertile land. The chief level tracts, however—and these are very extensive—lie to the north of the Augusta River, beyond 4° N.

We have omitted to mention that Heft 4, 1888, contains some interesting notes on the flora of the territory.

MISCELLANEOUS.

Mr. F. C. Selous left last May for an expedition into **Mashonaland**.

An admirable paper, beautifully illustrated, on the little known **Galla-** and **Somali-lands** is contributed by Dr. Philipp Paulitschke to *Globus*, Nos. 1-3, 1889.

According to the *Annuario Statistico Italiano* the population round the **District of Massowah** numbers 65,000 souls. In Massowah itself there were 16,000; in Monkullo, 15,000; in Archico and Otumlo, each 14,000; and in Emberemi, Zaga, and the Dahlac Archipelago (bay of Massowah), each 2000. **Assab** territory is reckoned to have 6800 inhabitants.

NEW BOOKS.

The Swiss Confederation. By Sir Francis Ottiwell Adams, K.C.M.G., C.B., and C. D. Cunningham. Pp. xx. and 289. London: Macmillan and Co., 1889. *Price* 14*s.*

Switzerland presents in rare variety and perfection the materials for a political bear-garden. Within its area live representatives of three (if not four) well-marked races, speaking four distinct languages (German, French, Italian, and Romansch or Latin). These three fractions border closely, without natural dividing line, on three great nations of their own blood and language. No two of the twenty-two cantons of the country agree in their constitution, and even differ widely from one another, though each is in many ways independent and supreme. Some are even highly oligarchic, others have model representative systems, others again are so democratic (in the Swiss sense) as to discard all representation, and settle their cantonal politics by mass meetings of the adult males. Then about one-half of the Swiss are very anti-Protestant Catholics, the other half Protestants (many of them very anti-Catholic): the antithesis has in some cases been so strong as to require a canton to be split into two administrative sections, one Protestant, the other Catholic. Some of the cantons came into the Confederation of free choice, some by force of circumstances, some by sheer conquest and compulsion.

It would seem to pass the wit of man to devise any scheme by which such multifarious and opposing elements should dwell together in unity. Yet the problem has been in a manner solved—whether by evolution or environment, common interests, lapse of time, luck, or good guidance; for six centuries the Swiss republic has been a very visible feature in Europe; and if it has had its internal and external difficulties, Switzerland has held wonderfully together, and Swiss patriotism has long been proverbial. Sir Francis Adams, Minister Plenipotentiary at Bern from 1881 to 1888 (whose death last month we regret to notice), and Mr. Cunningham have set themselves the task of explaining to English readers the mechanism—complicated, in some respects capricious, in many ways heterogeneous—by which this odd little confederacy continues to manage its affairs, in the main harmoniously, and for the common good.

Geography comes very little within the scope of the authors, though it seems to us that a little more on the unique geographical position and aspect of the country, and on its strategical value from the military point of view, would not have been out of place in such a work as this. There is not even an indication of the area (which is not quite half that of Ireland), though an appendix gives the population at the last census in 1888 as 2,920,723.[1] A little geography comes in incidentally, as under agriculture, where the various zones of culture are indicated.

The historical sketch is very brief, though interesting and lucid for the purpose in view—exhibiting the general constitutional development; but it would be well in speaking of the wars of the Swiss people with the Swiss house of Austria to explain that Austria in 1291 and 1388 had small resemblance to what we know as Austria, and had nothing whatever to do with Bohemia or Hungary.

The double sovereignty, federal and cantonal, is very carefully explained, and the tendency to increase federal power at the expense of cantonal autonomy. The federal assembly or parliament in its two chambers, the National Council

[1] *Vide ante*, p. 499.

and the Council of the States, has an analogy with the British parliament. But the executive, the Federal Council, which is practically the Swiss Cabinet or Government, is so unlike the governments of either of the other great republics, France and the United States, that we can well understand the Swiss saying, "We love our own republic, but not the republics of others." Government is not by party at all: the Federal Council accordingly is not composed of members of any one party—usually quite the contrary; it cannot dissolve the assembly, nor be dissolved by the assembly. The Federal Tribunal seems one of the least ingeniously contrived of Swiss institutions, being oddly limited in its power. The authors, after expounding that remarkable Swiss institution, the "Referendum" or reference, for final sanction or disapproval of laws passed by the chambers, to a plebiscite of the nation, hint that England might do well to try such a scheme for settling troublesome questions such as Home Rule. The democratic complement of the Referendum is the "Initiative" or power of the voters to insist on the chambers formulating specific new measures. It may safely be said that there are few Englishmen who will not learn much from the chapters on the cantons and on the communes, or who will not be surprised at the wealth of distinct and careful organisations that are found so closely side by side. It is well known that the Swiss people have a passion for education, but it would not be easy for twenty-two different sets of people to get more variety into systems of sound and compulsory education than the cantons have done. To a wealthy Bernese patrician is attributed the aphorism (which we here refer to a quite different sage), "It is for our advantage to educate our masters." One is startled to learn on the authority of the authors that the Swiss have a larger trade, per head of population, than any other European nation—though they too are feeling keenly the rivalry of others—German, Dutch, British—in their own special manufactures, at home and abroad, for coloured cotton goods. Thus the Dutch run the Swiss very close now in the Balkan peninsula, once the chief market of the Swiss. But the Swiss manufacturers are swift to adapt themselves to their customers; thus there are music-boxes that play respectively only Chinese, Japanese, or Persian tunes. The famous Swiss industry of wood-carving is only sixty or seventy years old. In a section on Religion the authors show very plainly their sense of the wrong inflicted by the authorities of Berne on Roman Catholics, in favour of the Old Catholics; and the recent expulsion of Jesuits, Mormons, and Salvationists is gently animadverted on. Socialism and anarchism, the right of asylum offered by Switzerland to political refugees and the embarrassments apt to arise with adjoining countries, give material for an interesting section. It is proved that though nominally eight cantons have re-introduced capital punishment, yet actually capital punishment is for all the cantons a thing of the past. The importance of Bern as a centre for a philanthropic regulation of the treatment of the wounded in war, of international organisation of posts and telegraphs, and protection of artistic and literary property, is discussed with some fulness. In regard to military affairs, it is significant and interesting to know that, whereas the British army costs £64 per man, the French and German armies £42, Switzerland has a well-equipped army of near 200,000 men at a cost of £7 per man. True, it is but a kind of militia; but it seems to be an excellent fighting machine for defensive purposes anyway. This is a matter worthy the attention of army reformers. Temperance reformers will note with interest that those who have for their intemperate habits been prohibited for a time frequenting public-houses, are in Switzerland put on a level with paupers and are not allowed to vote. Over-subdivision of the land leads to serious inconvenience: the authors heard of a case at Bern where a

cherry-tree was found to belong to seven different proprietors. The work closes with a comparison and contrast of Swiss institutions and those of the United States, and by both with those of Britain—a very valuable chapter at a time when the federation and the relation of the several states of a confederacy are so much in debate.

The work seems admirably done, but from the nature of the case it is at times a little dry, and can hardly claim any charm of style, though the statement is always lucid and terse. The authors have succeeded in doing on a smaller scale for Switzerland what Professor Bryce has done so recently for the United States; and all Britons, whether home-keeping or personally familiar with the outer aspects of Switzerland, owe them a debt of thanks.

Except to note the misspelling Rhoetia for Rhaetia (p. 2), the oddly divided word Tagsat-zungen (p. 11), the somewhat pedantic forms Luzern and St. Gallen *passim*, and "imperious" for "imperative" (p. 279), we have nothing to take exception to save the somewhat summary way in which Zwingli is pronounced to have been "more in accordance with the Bible" than Luther in the matters debated between them, and the most extraordinary parallel set up between Servetus and Archbishop Sharp (p. 179). The burning of Servetus was only equalled by the murder of Archbishop Sharp! Surely there could be hardly two cases less alike: a judicial execution for heresy after two months' trial, and a sudden assassination by a band of armed fanatics not for heresy but for cruelties (of which all recent research tends to lay the responsibility largely at Sharp's door). Surely all the Catholics executed by Henry VIII. and Elizabeth, or, if a Scottish case is required, the execution of the Edinburgh student Aikenhead for erroneous views, after the blessed and glorious Revolution, are very much more in point. The comparison is really so preposterous that a few similar extravagances would seriously impair the credit of the authors for sound judgment. All allusion to Calvin and Servetus' case, as well as to Archbishop Sharp, might well be spared, and should certainly disappear from a second edition of this useful, well-balanced, informative book.

From Pekin to Calais by Land. By H. DE WINDT. Map and Illustrations. London: Chapman and Hall, 1889. *Price* 20*s*.

Here we have an interesting, instructive, and well-told journal of what it professes to be—a journey by land from China to Europe through Siberia. It is remarkable that with contiguous boundaries of 2000 miles in length, this, with slight variation, is the only route available for accomplishing the transit by land. The western provinces of China, Kan-su and Sze-chuen, with Tibet, effectually shut up travellers and traders to the one route across the sands of Gobi. Perhaps both nations concerned prefer that it should be so. But a vast change will be effected as this route is shortened and a continuous line of rails shall have been laid from Moscow to Kiakhta, as is now proposed, or, it may be said, already commenced.

The narrative of the incidents and difficulties and trials of patience, and the weariness of the monotonous country and landscape, are vividly placed before the reader from the day of entering Tien-tsin to that of crossing the Great Wall, and on to that of once more meeting civilisation in the shape of a railway carriage at Tiumen.

Committing themselves to the care of Mongolian drivers and guides—a race which as individuals they did not find reassuring to look at or to associate much with from a general filth that clings to him wherever he goes—Kalgan, or Chang-kia-kow, with 150,000 inhabitants, upon the Great Wall, they

found to be on market-days a busy place, especially as a horse mart for the sale of beautifully-shaped, wiry little animals, generally of from 13 to 14 hands high. Here they found five Russian traders and six American missionaries, and were detained for a fortnight until a vehicle to cross the desert in had been made for them.

Leaving Kalgan they set out to the melancholy booming of camel bells for Urga, the capital of Mongolia and the residence of the Kootookta, a living god of the Mongol religion and an incarnation of Buddha, while the real ruler is the Emperor of China. The Gobi desert is a vast plain of 800 miles in breadth from N. to S., in which while there is seldom a total deficiency of vegetation, there is always a great want of water. Fourteen days of undulating grass plain, monotonous and unbroken; four days of deep sandy desert; five days of green plain, with intervals of gravel,—such is a description of the twenty-three days occupied in reaching Urga. Nothing meets the eye day after day, week after week, but one long succession of waves of plain; not a solitary object, animate or inanimate, broke the dull, desolate landscape save at rare intervals a solitary Tartar tent, gleaming white in the sunshine; and the Mongolian cart travelling at the rate of three miles an hour, the acme of discomfort and misery. At Toogoorook the rich pastures showed that the hardships of Gobi were nearly over, and the scenery between this and Urga improved as the valley of the Tola was entered on.

Urga, the capital of Mongolia, with 40,000 inhabitants, is the Mecca of Mongols, to which pilgrims from Mongolia, Manchuria, and Tibet resort, looking on Urga as only second to Lhassa. Here, as elsewhere where Russians were met with, the travellers had to listen to the national vaunts: "'Canaille va.'—'We shall teach you a lesson some day.'—'We'll take India from them some fine day.'" At Urga the native cemetery seemed to be an abomination, where the corpse is left naked to be torn by large dogs waiting for the repast. From Urga to Kiakhta took the authors a week, though generally covered by Russians in three days. Crossing three broad swift rivers and three passes, the country swarming with large hares and other game, Maimatchin (4000) and Kiakhta (6000) are the contiguous frontier towns of the two empires. From Kiakhta to Lake Baikal (Sea of Baikal, it must be called to please the natives), crossing the Selenga river by ferry boat, it required five days to reach Irkutsk. Notwithstanding a general feeling expressed by the author several times of approval and appreciation of the Russian character, the impression conveyed by the incidents of social life, by the overbearing character of every one in office, by the relations of sentries and convicts as recounted by him, is that it is the loaded rifle that is at the bottom of the fraternisation, and that it is fear of denunciation by superiors that is outwardly the bond of affection. The life of criminal convicts is rendered as pleasant as possible with the intention that they should be induced to remain as colonists, while to the political prisoner his life at Kara is "a hell upon earth."

The Sea of Baikal is 1200 feet above sea-level, and no bottom has been found at 6000 fathoms. Irkutsk, with fine shops and sumptuous hotels, has a population of 50,000. Gold seems to be found everywhere in Siberia, or at least "wherever it is looked for."

Formerly the exiles performed the whole journey on foot from Europe to Irkutsk. One-half is now done by rail and barge, Moscow to Nijni-Novgorod by rail, thence to Perm by barge, thence to Tiumen by rail, and by steamer from Tiumen to Tomsk, where the long tramp begins. The transportation is only carried on in summer, from the 15th April to 7th October. The roads are in

some places dangerous from robbers, with whom the drivers of vehicles are suspected to be in league. Constant delays are the weariness of Siberian travel. The towns generally are full of fine buildings and shops, as at Gadolovitch's in Krasnoiarsk, where everything may be bought as good and cheaper than in London.

From Tomsk the route to Tobolsk was by steamer, not very powerful and not over comfortable, and at Tiumen they once more entered the railway to Ekaterinburg and Perm, where they proceeded upon the Kama and Volga rivers to Nijni-Novgorod and Moscow. The railways are well managed, and fares low. The conclusion of all seems to be that persons intending to travel in Siberia should take Punch's advice to persons intending to marry (when they can take it): "Don't."

The perusal of travels such as these can hardly fail to raise in the mind of the political geographer the wonderful way in which the geographical distribution of the land has sufficed for the purposes of Providence in the distribution of nations, and how large portions of the habitable world have been reserved to the last for operations in the future on a large scale. From the early history of the world, when Greece and the islands of the Archipelago in the eastern corner of the Mediterranean were the theatre of operations both in peace and war, on a scale at the present day microscopic, which theatre has been extended to Europe, with its distinct geographical boundaries and numerous nationalities, in the present day we see the largest rivers and the most extensive masses of land hitherto kept in the background, and apparently reserved for some great events in the future. China, wonderfully shut out from intercourse, Siberia, North America, South America, and Africa are destined to be the theatre of great events in the future.

In his stay in Shanghai it is surely a stretch of the author's imagination when, among other little romances, he describes the tea garden in the city as an oasis in the desert of filth and squalor, a hidden corner of cleanliness and picturesque revelry. He repeats the oft-quoted statement that Russian merchants are able to send finer tea to Europe than any others, though competing in the open market. He seems to take on innocent trust the assertion: "You English boil your tea. How can you expect it to be good?" By an error of the pen he calculates that in a few years forty millions of *chests* will pass Kalgan, meaning thereby *pounds*, and he believes that brick tea is mixed with bullock's blood to give it flavour.

Half-a-Century of Australasian Progress: A Personal Retrospect. By William Westgarth. Pp. xxxii. + 423. London: Sampson Low and Co., 1889. *Price* 12*s*.

This volume consists of two "Parts," the first containing the itinerary of a tour, the second dealing with various Colonial or Imperial questions; but Part I. while containing many interesting comparisons arising from a retrospect extending over forty years, and a pleasant record of hospitalities which, always accorded in Australia to the well-accredited traveller, naturally fell in twofold profusion to an old and distinguished colonist, also deals *en passant* with various questions of importance. Among these is a question, the promotion of which seems to have been one of the chief objects of the author's journey, viz.: the consolidation of the finances of the different colonies. *Cæteris paribus*, a stock, of which a large amount exists, is more marketable than one of small amount, and the author is confident that if the funds of the different colonies were thus consolidated and

unified, they might be converted into a uniform three per cent. loan ; and even the inclusion, in such federation, of a colony whose finances were temporarily less prosperous, as *e.g.* New Zealand at the present time, would, Mr. Westgarth believes, be more than counterbalanced by the advantages and conveniences of the scheme. On questions such as this, the views of so experienced a financier, acquainted alike with the feeling of the home market and with the affairs of the colonies, cannot but have much weight. The writer's views—or shall we say speculations?—on several other important questions stand on a somewhat different level. With characteristic energy and wonted activity the veteran author in his Part II. starts not less than eight or ten such problems. But they do not as a rule receive adequate discussion, and some are dealt with very summarily. The reader, therefore, who may on some of these questions think differently from the author, will not improbably, however interested in the writer's treatment of them, nevertheless retain his own opinion.

Two Kings of Uganda. By ROBERT P. ASHE, M.A., F.R.G.S. With Map and Illustrations. London : Sampson Low and Co., 1889. Pp. 342. *Price* 6*s*.

Mr. Ashe, after six years' residence in Eastern Equatorial Africa, chiefly on the shores of the Victoria Nyanza, has a story to tell with the outline of which many of us are only too painfully familiar. His book deals for the most part with the experiences of the Buganda Mission, to which he was attached, under the successive rules of Mutesa and Mwanga. We thus have for the first time a complete and trustworthy account of those terrible times which the mission and the native converts underwent after the death of Mutesa. The brief but bloody reign of Mwanga, and the persecutions against the native Christians, are described in considerable detail. Incidentally we learn a great deal of Buganda and the Baganda, and the closing chapters deal exclusively with the manners and customs of the different tribes. The murder of Bishop Hannington is also referred to at some length.

If we learn anything from Mr. Ashe's book it is that the Baganda represent a force in that part of Africa which, properly utilised, might be productive of much good. They have shown themselves capable of adopting certain forms of government, however autocratic and barbarous ; they appear to be divorced from Lubareism and to have successively coquetted with Islam and Christianity. Mr. Ashe claims, no doubt justly, an extraordinary success for Christian teaching. The noble martyrdoms of so many of the natives cannot fail to produce fruit in its season. It is some time now since we heard from Buganda, so that we do not know whether the anarchy that broke out after the flight of Mwanga's successor has continued, or whether better counsels have prevailed. It is certainly to be hoped that the mission to Buganda will be restored at the first fitting opportunity, for the importance of keeping in touch with this State, and if possible of establishing friendly relations with it, are greatly emphasised by what Mr. Ashe tells us. With men like Hannington, Mackay, and Ashe in Buganda, much might be done in the future to effect an entrance for European influence into the heart of Africa. The importance of Buganda cannot be overlooked in any schemes launched with this object. On the other hand, if Emin is forced to evacuate his province, and that part of Africa is thereby allowed to drift back into its former hopeless condition, Buganda will offer a powerful nucleus for Arab ascendancy. The present outlook is bad enough. Mr. Ashe's book should be widely read ; it is deeply interesting, and records a state of affairs that is in many respects quite unique in Africa.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

NARRATIVE OF AN EXPLORING EXPEDITION TO THE EASTERN PART OF NEW GUINEA.

(*Read at Meeting of British Association*, 1889.)

By Basil Thomson.

The part of New Guinea which was finally annexed by Great Britain in September 1888, comprises about one-third of the great island continent, and the numerous detached islands which form the archipelagos of Louisiade and d'Entrecasteaux. Although several expeditions have explored the coast-line and river banks of the western portion of the Possession, the interior of the islands and the dense forests which cover the eastern end had remained unexplored until October last year, when the expedition I am about to describe was undertaken, partly to reassure the natives as regards the objects of the newly established government, and partly to gain official knowledge regarding the capabilities and natural resources of the country. For several years the shores and reefs of the Louisiades had been visited by the boats of the *bêche-de-mer* and pearl-shell fishermen, and the murder of several of them had earned for the natives an evil reputation. And when last October the rumour of a gold-field in Sudest Island was likely to attract a crowd of miners from Australia it was felt necessary to exercise some control over the intercourse between Europeans and natives, if the latter were ever to be benefited by annexation. Moreover great interest was attached to the flora and fauna of the Louisiades, a group of islands of a most peculiar geological formation, and separated from New Guinea probably at a very remote period, for in botany and entomology they were an entirely new field for the collector.

We left Port Moresby, the seat of government, on September 20th, and after traversing the first seventy miles of coast on horseback, and visiting the principal villages of the Motu, Saroa, and Loyalupu tribes,

we embarked at Kerepunu in the schooner yacht *Hygeia*, and spent the next ten days in beating against a strong head wind to Sudest, where we found that a large number of miners had already arrived. The formation of this, the largest of the Louisiades, is slaty, with veins of crystalline quartz running through it in all directions. The eastern portion is mountainous, reaching in Mount Rattlesnake an altitude of over 3000 feet. The higher parts are densely wooded, but the low hills near the sea are covered with grass whose bright green is a most welcome contrast to the sombre tropical forest. The gold was found to be distributed most capriciously, some of the creeks proving very rich, while others yielded scarcely a trace of the metal. It was scattered along the creek beds among the gravel and sand which had washed into the interstices of the slate. The island was thinly inhabited by a tribe who have been for years the prey of head-hunting parties of the more warlike Brooker islanders. They had shown no hostility to the miners, who had even made use of them to wash gold; and in one case a native had sold some 4 ounces of gold, value about £15, to a miner for two sticks of tobacco, worth about a halfpenny. But the villages near the mining camps had been deserted, and the women and children had been hidden away in the forest. The Sudest islanders share with the other natives of New Guinea the extraordinary facility in acquiring words and sentences of English they can only have heard said once or twice, which has astonished every traveller who has visited the islands. We crossed the island, and were able to examine the geological formation of the high ridges which form its backbone.

On October 9th we sailed for Rossel Island in H.M.S. *Swinger* having the *Hygeia* in tow, taking with us twenty miners to prospect for gold. The island is surrounded by a distant barrier reef of irregular form, terminating in a most dangerous acute-angled projection on the south-east end known as Rossel Spit, which has been the scene of numerous wrecks. Rossel Island, owing to its isolation, its gloomy forests, its inaccessible mountains, and the evil reputation of its inhabitants, had acquired a character of mystery and danger which lent peculiar interest to its exploration. It is said that in 1858 the ship *St. Paul*, bound from Hong-Kong to Sydney with 327 Chinese immigrants on board, was totally wrecked on Rossel Spit, and that when the French steamer *Styx* came to relieve the shipwrecked crew some months afterwards it was found that all except one Chinaman had been killed and eaten by the natives. As no European was known to have penetrated inland, we determined to try to cross the island, and it was with no little surprise that we saw before us a mass of precipitous mountains clothed to their summits with dense forest, and except in a few isolated patches apparently with no larger clearings than would suffice for the support of a hundred people. At a small off-lying islet, named High Island, we secured as our interpreter a boy who had learned a few words of "pidgin" English on a Queensland plantation; but on the following day, having learned that we intended to proceed inland, he protested that the men of the interior would kill us, and that if he went with us they would kill and eat him after our departure. Then to further secure his

safety he jumped into a canoe, paddled ashore, and we never saw him again. Nor were we more successful in engaging carriers, for the inhabitants of the village opposite to which we were anchored no sooner learned our intentions than they followed the example of our interpreter.

On the following day we started, a party of six Europeans and one Lifu islander, to ascend the main range of the island, which formed a barrier between us and the interior. Each man had to carry besides his arms 25 lbs. weight, his share of the camp furniture. Landing at the foot of the range in drenching rain, we spent the day in following a native track which wound along the crest of a ridge, and encamped at nightfall in a deserted native village. The following day was spent in drying our clothes and the contents of our packs, which were wet through, and in collecting specimens in the swampy forest which surrounded the village. It is difficult to convey the extraordinary impression left by the first sight of a New Guinea forest. The gloom of the sombre dark green foliage would be most depressing were it not continually relieved by some beautiful flowering orchid, or the flash of some brilliant bird that darts like a coloured flame into the depths of the forest. For New Guinea is the land of beautiful birds. There even the most sober-hued of our birds assumes a brilliant plumage as if to be in tune with the wonderful birds of paradise. This forest was a very rich field for the botanist. The richness and beauty of the orchids, the variety and grotesque forms of the pandanus, made us regret that we were not better provided with apparatus for preserving specimens of the many new forms that we saw at every turn of the path. We found only three species of beetle,[1] two of which were new to science.

Next morning we again climbed the range, passing through forest too dense to afford any view of the surrounding country, and at length struck a path leading eastwards which gave us occasional glimpses of the southern shores, 2000 feet below us and some six miles off. This track, steadily descending, suddenly widened into a well-kept road a chain broad. It had evidently been cleared long ago, and was kept carefully weeded, so that we were surprised to find at the end of it, instead of a large and populous town, a tiny village naturally fortified. We halted to get our arms ready, and then advanced in our usual order of *suaviter in modo* in one hand and *fortiter in re* in the other—that is, offering our hosts the choice between a handful of tobacco if they were friendly, or the contents of our revolvers if they should attack us. There was abundant evidence that the natives had left in a hurry. The fires beneath the houses were still burning. Native dogs were skulking about the village and howling dolefully (for the dingo never barks), and two long-nosed amiable-looking pigs were gazing at us with suspicion. The view was lovely. Below the hill on which the village was perched a little river ran, its banks dotted with plantations and belts of park-like timber, and backed by Mount Rossel, towering 3000 feet above us. The village itself was beautifully swept and clean. The houses, nine or ten in number, were built in irregular form some three or four yards apart, but two of them

[1] A *Lachnosterna* and a *Lepidiota*.

perhaps those of elders or chiefs, were built apart on higher ground on which were some rough stone seats which we afterwards learned were used as the village "forum." Unlike those of the neighbouring islands, they were shaped like an inverted boat resting on a platform some five feet from the ground, and as the shape of the thatched roof allowed no door at either end, the interior was reached through two trapdoors in the floor. Each of the six posts supporting the platform was surmounted by a round disc of wood to prevent rats from climbing into the thatch. The floor inside the houses was littered with earthen pots, baskets containing sago, and the few tools with which a Rossel islander is equipped to fight against nature. Bundles of spears, formed from the outer rind of a palm, and generally without barbs, were suspended beneath the eaves ready to be snatched up on an alarm. Under the eaves of the largest house were one or two skulls on a shelf, and a heap of human bones mingled with those of the dugong and turtle were piled up in a corner of the village. Cooking was carried on in the space beneath the houses, the pots being supported on a triangle of stones. But the stone age was passing away in Rossel, and the iron age had come upon even this most remote corner of the earth. In place of the greenstone blades we found the old handles fitted with iron adzes formed from an iron chain plate, ship's bolt, or even a five-inch nail, doubtless obtained by barter from the people of the south-east coast, who plunder the wrecks that have made Rossel Spit so dreaded by navigators.

We slung our hammocks underneath one of the houses, and spent the night disturbed only by the weird cries of the dingoes and nocturnal birds. Next morning, while on our way to another village in which we had put some tobacco overnight, we came suddenly on a party of nine or ten natives unarmed and carrying cocoa-nuts towards the village in which we had slept. If they were intended as a return for the tobacco, or as a propitiatory offering to their strange visitors, the sudden apparition of a white man was more than sufficient to dissipate whatever friendly feelings they may have entertained towards us. They simply dropped everything, and dashed into the long grass scattering, like a herd of deer suddenly disturbed, and our conciliatory cries of "Gemba" ("Peace") seemed only to make them run the faster. The rest of the day was spent in winding the network of native paths, or cutting our way bodily through the tangled sago swamps, until about evening we emerged upon a high hill overhanging the sea. No better place could have been found than this which we had stumbled on by accident. The southern coast lay spread like a map at our feet, its fertile valleys and forest-clad ridges, except for a few small villages and clearings, almost untouched by the hand of man. Stretching many miles to seaward was the white line of foam which marked the notorious Rossel Spit, and further to the eastward the low wooded island on which the ill-fated Chinamen of the *St. Paul* are said to have been confined, half-starved, while the natives carried them off to be killed and eaten at the rate of three a day, until only one was left to tell the story.

We camped for the night near a small plantation, where the inevitable conch shell hung close by for women working in the plantation to snatch

up and summon the men to their assistance when surprised by an enemy ; and on the evening of the following day we regained the ship by another route across the range. The miners had found indications of gold in one of the creeks that had its source in Mount Rossel, but not in sufficient quantity to repay working.

The natives of Rossel have few of the characteristics of the pure-bred Papuan. The prominent nose, large eye, and delicate features of the latter are replaced by the negroid character of the Melanesian, wide nostrils, flat nose, and prognathous head. They are short and squat, of that sooty brown complexion that resembles black. They bore the cartilage of the nose, which is usually ornamented with a shell whorl, and enlarge enormously the lobe of the ear, but do not tattoo. Their food consists of sago, taro, plantains, and other fruit, with fish, pork, or turtle occasionally added. The men's dress consists of a single pandanus leaf secured round the waist by a cord of human hair. The women wear several thicknesses of grass petticoat. From the number of weapons and human bones in their villages it is probable that they are constantly engaged in intertribal wars, and are addicted to head-hunting and cannibalism. We gathered, from a scanty vocabulary obtained from the interpreter, that their language is unlike any New Guinea language with which we are acquainted. The numerals, except 4 and 9, seem to be from a different root. They count up to ten and then repeat, but seem to have distinctive words for all the decimals up to a hundred. There is a great predominance of the *ā* sound, and no *k*, and they have a curious half-querulous intonation that makes the language very difficult to pronounce. It is the first Papuan language we have found to have the ellipted consonant sound as in the Tongan *ji'i* and *uma'a*, instead of *jī* and *umāā*.

After visiting the islands of Sudest and Joarmet, where some of us in visiting a village narrowly escaped injury from a circle of sharp spears planted in the long grass at an angle of 45°, we anchored off the hitherto unexplored island of St. Aignan, called by the natives Misima. This island is more than 100 square miles in area, being about 28 miles long, and varying in breadth from nine to about three miles. The eastern part consists of very rugged hills, through which the streams have cut deep and narrow gorges. They are composed of coral upheaved by volcanic action, mixed with conglomerate formed from shingle, and containing broken layers of schistose slate. Round the eastern coast there is a fringe of coral upheaved more recently to a height of 100 feet, through which the mountain torrents have cut their way right down to sea-level. The western part consists of a great mountain range called Lakia, about 3500 feet high, composed of schistose slate, so abrupt that on the north side it overhangs the sea in one tremendous precipice. The formation of the island being igneous, it is not protected by a barrier reef. We anchored about the centre of the island, on the north side.

The natives were of two types, the one evidently Papuan, and the other betraying strong Malay characteristics, such as the straight hair and unprominent features. They were a great contrast to those we had hitherto seen in their boisterous and demonstrative friendliness, their

vivacity, and their intense eagerness to trade. When they found we were collecting specimens of natural history we were overwhelmed with offerings of live opossums carefully muzzled, bags full of live beetles, and even strings of fluttering butterflies fastened together and hung round the collector like a necklace. They showed no fear of us, nor did we seem to interrupt the ordinary daily routine of the village. The women were to be seen nursing their children, drawing water, and cooking, as if unconscious of our presence. There are two large inland villages in St. Aignan, the inhabitants of which are on friendly terms with the natives of the northern coast; but although there was no actual war while we were there, the villages on the south side were sufficiently unfriendly to make it death for one of our hosts to venture alone among them.

On October 23d, having anchored further down the coast, we made an expedition into the hills of upheaved coral, which are honeycombed with caves. Among these is a subterranean river called by the natives Kaiaba. After crossing a high ridge of limestone we found ourselves on the edge of a precipice 200 feet high. We stood on an undermined ledge of coral, while below us to the right was the keystone of a tremendous arch. The rocky precipice completely surrounded an amphitheatre a quarter of a mile in diameter, through which the river rushed. Where it had its source we could not guess. It burst from the face of one mountain, and after a short glimpse of daylight plunged into the depths of an immense cave. This cave was 150 feet from floor to roof, and encumbered with great boulders, round which the river foamed. Huge stalactites hung from the roof, and stalagmites sprang to meet them from the floor, looking like a garden of cacti petrified or frozen into solid glistening stone. At the far end the river thundered down into a black tunnel, and so passed under the range. A curious feature was a single tree, nourished only by the naked rock, that divided the cave's mouth from floor to roof. The dim light coming green through the foliage that hid the sky at the cave's mouth, the roar of the water, and the grotesque forms of the stalactites, left a most weird impression on us, the first white men who had set foot upon that spot.

The natives of St. Aignan do not appear to have any religious belief, nor to have troubled their heads about a future state. The interpreter told me that it was quite possible that white men existed somewhere after death, but that his people certainly did not. Their belief in the supernatural is confined to witchcraft; and the idea that no one can die except from the spells of some wizard of a hostile tribe is the cause of most of their wars. The dead are buried, but the head is sometimes afterwards exhumed and placed in a stone cairn. The skulls suspended outside the houses are those of enemies, for, though the St. Aignan people are probably not addicted to cannibalism, they are head-hunters. Polygamy is allowed, but is not common. The usual price of a wife is a stone hatchet, shell earrings, and three pigs, which, although nearly as much as would be paid for the life of a warrior, is not exorbitant, considering that a wife cuts wood, draws water, and even plants the food on which her husband is to subsist. But the primitive simplicity of St.

Aignan is to be broken in upon. We found there indications of alluvial gold, and since our visit gold-diggers have visited the island in considerable numbers.

After visiting a small island called East Island, composed of upheaved coral, where the natives all fled to the bush at our approach, we anchored off the north-east point of Normanby Island, on the evening of October 25th. We were at once surrounded by canoes manned by natives clamorous to trade. Normanby, the most easterly of the d'Entrecasteaux group, is a narrow L-shaped mountain range, with sides deeply furrowed by water wear. The area is perhaps 350 square miles, and the mountains do not exceed 4000 feet in height. Like St. Aignan, it has no protecting reef. The SE. portion is composed of schistose slate, interlaid with veins of white crystalline quartz. In this part traces of gold were found in the creek beds. At the north end the formation is igneous, consisting mainly of limestone, but boulders of basalt and siliceous stone were found in the creek beds. The mountains of Dawson Straits, however, are of a different formation. The rock seemed to be a kind of porphyry, and furnished indications of tin. It deserves a more thorough examination. The north-east point of the island is densely populated and elaborately cultivated. On the 26th the Administrator and I, accompanied only by one coloured servant, penetrated some miles inland, and passed through no less than thirty-one villages. Every peak of the ridges had its crest of houses nestling among cocoa-nut palms, and every rood of the hills was under cultivation. Some of the plantations could not have been less than 30 acres in extent, and each was surrounded by a substantial fence 5 feet high. We saw one garden on a slope of at least 60°, and felled trees were pegged at short intervals horizontally to prevent the soil from being washed down by the rains. The houses were quite unlike those in the Louisiades. The villages averaged nine or ten houses, each built in a rough circle round an open space, in which was a grave fenced in, and planted with crotons, amaranths, and hibiscus. The houses were saddle-shaped with high-peaked gable-ends, built upon the usual platform, and the walls ornamented with painted diagonals. Our visit disturbed the daily routine so little that in one village where the central figure was a man having his hair combed by the village barber, who, by way of diversion, frequently transferred his attentions to his own mop, the two, after glancing carelessly at us, resumed operations, and took no further notice of us.

Normanby is the eastern limit of the largest of the five species of Manucodia, whose restricted range and extraordinary anatomical structure is so difficult to account for by any theory of evolution. The bird is about the size and shape of a crow, but the plumage is of a deep metallic steel blue, and all the feathers are crimped. But its curious feature is that the windpipe after leaving the throat passes down beneath the skin to the tail, and then returns before entering the thorax. We shot a smaller variety, new to naturalists, in which the windpipe is neatly coiled on the breast beneath the skin, the average length being about 18 inches. Perhaps this peculiarity may account for the striking cry of the manucodia—a long, low tremolo whistle of so penetrating a *timbre* that it

can be heard a mile from shore. Although the strait that divides Normanby from the mainland of New Guinea is barely ten miles wide, this bird is found nowhere but in the d'Entrecasteaux Islands, where it is the commonest of all the large birds. The manucodia and the bird of paradise, known as the *Decora*, are illustrations of Wallace's discovery in the Malay Archipelago, namely, that very few birds will cross a strait of deep sea, however narrow. It will be remembered that he found a different fauna on either side of the strait that divides Bali from Lombok, a piece of water no greater in width than the strait that divides Normanby from the mainland. Though some of the marsupials of New Guinea are found in the islands, the isolation of these birds, who, as far as food and climate are concerned, would thrive equally well on the mainland, seems to indicate that the d'Entrecasteaux Islands were separated at a very remote date.

The various tribes on the north coast of Normanby seem to be hostile to one another, and to speak different languages. So complete is their isolation that in all respects but their physical characteristics they are different peoples. At a spot not ten miles from a tribe that would barter all they possessed for tobacco and pipes were people so ignorant of their use that they put the tobacco into a bottle we had given them, poured water upon it, and drank off the compound.

On October 31st we anchored between Goulvain and Fergusson Islands at the foot of an extinct volcano. Fergusson, the largest of the d'Entrecasteaux, is some 300 square miles in area. There are three great mountain ranges, the highest of which, Mount Kilkerran, is some 6000 feet above sea-level. The formation of these mountains is micaceous schist intersected by veins of quartz, but boulders of what seemed to be a kind of porphyry were found in the creek beds. No trace of gold was discovered. The south-eastern and western parts of the island are of igneous formation, and we observed near the extinct volcanoes some hot springs. The eastern end is densely populated, owing probably to the fertility of the extensive flats of rich volcanic deposit. The natives were as boisterous and friendly as their neighbours of Normanby, and showed the same eagerness to trade. We found here a most elaborate system of cultivation. A volcanic flat several hundred acres in extent formed one huge yam plantation, being divided into rectangular blocks by neatly-kept paths. The reeds up which the yam vines were to run, instead of being merely stuck upright into the ground as is done elsewhere, were inclined inwards towards a stake planted accurately in the centre of every four yam hills, and the whole plantation was kept weeded with a regularity that would put an English gardener to shame. Not ten miles from this industrious and friendly people we had an example of how completely war and differences of dialect may isolate uncivilised man. On landing in a small bay on the north side we were surrounded by a crowd of armed natives gesticulating in so wild an excitement that we were obliged to discharge a rifle to produce an impression on them. From the effect it was evident that they knew nothing of fire-arms, and they did not seem to care for any of the trade articles that are so eagerly sought for in other islands. Accompanied by our demonstrative escort,

we followed the beach until we came to a dry branch stuck upright in the sand. Beyond this our companions would not pass, and they tried hard to dissuade us from going further, making signs that we should be speared if we did. We soon saw another crowd of armed natives watching us from the cover of the trees. We eventually overcame their suspicions, and made our way, in spite of numerous taboos, to their village, a cluster of ill-built huts high up the mountain; but finding there that they would resort to stronger measures than "taboos" if we persisted in going further, we returned to the beach. Had we been able to explain to them by an interpreter that we were as friendly disposed towards them as to their enemies, with whom they first saw us, I have no doubt that they would have welcomed us; but these savage Ishmaelites, who receive visits from none but enemies, could not have regarded the first appearance of a white man with anything but suspicion. That a narrow bay should be the frontier between two hostile villages, who must dispute even the food they plant at the point of the spear, illustrates well the social condition of this large and populous island.

Among the natives of New Guinea gestures denoting goodwill are in frequent use, and one can sometimes avoid the difficulty of first opening communication with them by noting and imitating the signs they make to strangers. A little further down the coast I saw a native repeatedly touch first his nose and then the middle of his body with the first finger, and then, as he elicited no response, prepare to run away. As soon as I repeated the sign he flung down his spear and came up without fear. This sign was useful to us afterwards on the west side of Fergusson.

At another place we were made to submit to a less pleasing ceremony. We landed among a crowd of armed natives, who showed the greatest suspicion of us. As they would take no tobacco nor beads from us, and declined even to sniff the bottle of strong ammonia with which we were wont to impress our superior powers upon these children of nature, we were obliged to fall back upon an old newspaper, which we tore into small squares, and distributed with an air of great generosity. The interest shown in these talismans was so great that we were able to sit down on the sand without fear of molestation. After a long discussion an old man rose up solemnly, and, having chewed a scented bark resembling sassafras, he spat it over each of us first, and then over his own people. The effect apparently was to make unfriendliness impossible.

In the narrow strait which divides Fergusson from Goodenough Island we at last found the one mountain in the world on which the beautiful bird of paradise (*Paradisea decora*) is found. We had heard of its existence from the natives, but as we had failed hitherto to find a trace of it we had almost given up the hope of obtaining it. This bird, which is like the *Paradisea raggiana* in all respects but the shield, which is grey instead of black, is restricted to Mount Maybole, where it is found at a height of 2000 feet. We spent a night on the range, and secured seven specimens. The habits of the birds of paradise, of which there are now thirty-seven known species, have been too fully described by Wallace for me to touch upon here, except to describe the method of shooting them. The birds begin to call at daylight, and to collect upon the "dancing

tree" until about 7.30 A.M., when they separate, and disappear until an hour before sunset. The call is unmistakable, and can be heard for a great distance. It is perhaps best described in writing as,—*kaūk-kāuk-kōk-kōk-kok-kōk*. It is easy to imitate, and the bird will approach within shot, flying from tree to tree in response to the imitated call.

In Seymour Bay, a little to the westward, we found a large extent of low hills and saline lakes, that gave off sulphur fumes, strong enough to discolour the white paint on the vessel lying nearly two miles distant. The hills were composed of alum and sublimed sulphur, and were surrounded by springs of boiling water and boiling mud, which, in one instance, was spouted up with great noise from a chimney-like cavity in the hill-side. The day is probably still distant when this place will become a fashionable health-resort.

We spent two more days in exploring the eastern portion of Good-enough Island, whose twin peaks rise to a height of 7000 feet, and then sailed for the mainland. We had, with a small party, examined a number of islands whose inhabitants, if they had ever seen Europeans before, had good reason for feeling hostility towards them; but the whole expedition had been accomplished without any collision with the natives. They are undoubtedly treacherous and untrustworthy, especially when their cupidity is excited; but provided that travellers will observe ordinary caution and vigilance, respect native customs, and pay for everything they receive or are obliged to take, I believe that a very small party can traverse the islands without danger. The small collections of flora and fauna we were able to make during our flying visits show how desirable it is that a systematic examination of the islands should be made in the interests of science, for a large proportion of the butterflies, beetles, and land shells that we collected are new species.

We had hitherto seen the natives in their most favourable light; we were soon to know them in a very different character. On our way to Samarai we sighted what appeared to be the remains of a vessel burnt to the water's edge on a part of the coast seldom visited by Europeans. At Samarai we learned that, a few days previously, an Englishman had been murdered in this bay, and his vessel plundered and burnt. Of the two natives who composed his crew, one had been badly wounded, and the other had escaped to Samarai. As the usual punishment for these outrages—that of despatching a ship of war to the spot to shell the villages while the natives looked on from the shelter of the hills until it was safe to return—had proved insufficient to check them, it was determined, if possible, to arrest the actual murderers. Accordingly, one dark night, we approached the land under cover of darkness, but not before a line of signal fires had announced our arrival from far down the coast. In perfect silence we landed, groped our way to the village, and posted men at each house,—only to find that the houses were empty. When daylight enabled us to search the village we found that the plunder from the wreck had been distributed among the people of an area of some hundred square miles. It was curious to notice the different uses to which the various articles had been put. The wire rigging unravelled had been converted into nets, the sails cut up were in use as bedding, and the bolts

and chain-plates were already in process of being ground down for adzes. It would be wearisome to describe the incidents of the next four weeks. The natives had retired to the most inaccessible parts of the mountains. We followed them there only to find them more than our match as mountaineers. We captured several prisoners from time to time, who at once turned against their own side, and gave us all the information we required, but the actual murderers remained at large, and as offering rewards seemed useless, we were driven to keeping them in the mountains by preventing them from obtaining food from the plantations. At length, on November 28th, we had a practical illustration of the methods of New Guinea warfare. On landing at the village of Huhuna, in which one of the murderers was reported to be, we were received with marks of friendship so extravagant as to raise our suspicions. They were confirmed by the anxiety of the natives to separate our party of twelve men, and the discovery that bundles of spears were hidden in the grass at the side of the path. Four of us, however, were detailed to go into the village and endeavour to arrest the murderer Yakopa. Scarcely had we left the others when a curious cry, not unlike the cry of curlew, was raised between us and the boat. We realised without the aid of whistling spears that it was the war-cry. But at a turn of the road we met Yakopa, the man of whom we were in search. He was seized and handcuffed with some difficulty, but his repeated cries made him a rallying point for the enemy, and we soon found ourselves in a hot fire of spears and stones discharged from the dense undergrowth that surrounded us. We had scarcely gained the beach with our prisoner before the natives made a rush in considerable numbers. Their weird cries, the whistle of the spears, and the crack of the Winchester rifles made it difficult to observe them closely; but it was evident from their pluck in making three successive charges that this was their first experience of fire-arms. Having failed in their attack on our front, they attempted to take us in flank, without leaving the cover. This enabled us to shove the boat off, and get out of spear range, and so avoid the necessity of firing on them in self-defence. Although they outnumbered us many times, none of our party received a scratch. They were perhaps too much startled by the report of fire-arms to take careful aim, but the Papuan is inferior to the Australian native in throwing the spear. He cannot throw accurately for more than fifty yards, and he is so long poising and taking aim that it is not difficult to dodge it. Although the inferiority of their weapons renders them comparatively harmless in open attack, they are by no means to be despised when they have an opportunity of taking their enemy unawares; and although I believe that in their own warfare pitched battle is seldom resorted to, they certainly showed great courage on this occasion, unaccustomed as they were to the sound of fire-arms.

These people are head-hunters and cannibals, as indeed are nearly all the coast tribes of eastern New Guinea. The consideration and importance of a man in the tribe seems to depend upon the number of skulls he can hang up on the verandah of his house, and as in parts of Europe hereditary titles can be purchased, so in New Guinea a man rich in adzes, pigs, and shell money, by buying skulls from other tribes can acquire the

distinction that attaches to personal prowess. One of our native allies fell into an ambush, was killed by the natives of Ahioma, and was immediately cooked and eaten.

Their spirit was broken after this encounter, and not many days afterwards the murderers were given up to us, brought to trial at Samarai, found guilty, and executed. The line of action taken in this case has produced the happiest effect, for on our revisiting the district we found the people again settling in their homes, and thoroughly impressed with the power of the Government to punish evil-doers.

The political future of New Guinea will probably not be a brilliant one. When Australians get tired of their new toy—a real dependency of their own—colonisation will flag. Unless gold is found there the country will probably remain undeveloped for years owing to the difficulty of procuring cheap labour and carriage. But to the naturalist the country is one of absorbing interest, and the results of even a small private expedition, such as that of d'Albertis, would amply repay those undertaking it for the toil and expense.

NOTE ON THE FAUNA OF THE LOUISIADE AND D'ENTRECASTEAUX ISLANDS.

The physical characteristics and geological formation of these islands have been briefly described in the preceding paper; but as the distribution of the fauna has, when considered with other indications, an important bearing on the history of the islands, it will be well to recapitulate briefly the main features already adverted to.

The scattered group of islands—varying in size from about 270 square miles to a tiny islet—known as the Louisiades are connected with the mainland by a chain of submerged coral reefs and a shallow sea. Except in one instance, St. Aignan, which lies some miles to the northward of the chain, we saw no indication that any of the islands were rising.

The d'Entrecasteaux group, on the other hand, consisting of three large islands, lies nearer to the mainland, but is separated from it by a narrow strait of deep water. Although their formation is generally similar to that of the Louisiades, there are ample indications of an active volcanic agency, and, in the igneous rocks, of a gradual upheaval.

If Wallace's deduction from the distribution of the fauna in the Malay Archipelago be correct, viz., that the islands separated by a shallow sea have comparatively recently been connected together, and that the deep strait between Bali and Lombok has, although so narrow, prevented the admixture of even the avi-fauna of either side of it, we should expect to find a greater affinity between the fauna of the Louisiades and the mainland than between the d'Entrecasteaux and the mainland; in fact, if the latter had been separated at a very remote period, we might expect to find forms peculiar only to the d'Entrecasteaux.

The very imperfect examination we have been able to make of the fauna has served to show that, the physical conditions of the two groups and the mainland being equal, two at least of the birds are peculiar only

to the d'Entrecasteaux, one of them being perhaps the commonest species in the islands.

The strait which separates Normanby Island from the mainland of New Guinea is about ten miles wide. Yet the *Manucodia Comrii*, a large slow-flying bird, has never crossed this strait. In the d'Entrecasteaux Islands it is by far the commonest of the large birds, and its penetrating note can be heard more than a mile from the shore. This bird is very tame. It never settles on the ground, but if disturbed it flies to the next tree, where it remains jumping from bough to bough with great activity, and craning its neck forward in a most characteristic manner.

More remarkable still is the limited range of the *Paradisea decora*. A few specimens of this rare bird were obtained by Mr. Goldie several years ago, and it was partly to search for it that we visited the western part of Fergusson Island. At every place we anchored we showed the natives a skin of the *Paradisea raggiana*, which closely resembles it, and asked them if they knew it, but without result, until we reached the foot of Mount Maybole. Here the natives recognised the skin, and pointed up the mountain, and at a height of 2000 feet we heard to our delight the unmistakable cry of what seemed to be the *Raggiana*, and secured six full-grown specimens of the *Decora*. I felt sure that if the bird existed in Normanby Island, or any other part of Fergusson, the natives would have known it, for they prize the skin highly as an article of trade to other islands.

In our expeditions inland we failed to find a trace of any other bird of paradise in these islands, though the *Regius*, *Magnificus* and *Raggiana* are common enough on the other side of the strait. That the *Paradisea decora* is confined to one mountain only in the group would point perhaps to some cause through which the bird is gradually approaching extinction, but this will not account for the limitation of the Manucodia, which exists in such numbers on the islands.[1] The butterflies obtained in the d'Entrecasteaux are Papuan, and show relationship to those of the neighbouring groups of Kei, Aru, on the west of New Guinea. One or two of them, such as *Eurema hecabe* and *Leptosoma integrum*, show affinities to the Indo-Malayan fauna. The most interesting of the new species was a Tenaris, a genus which here attains its maximum development. The majority of the butterflies were caught in the dry, rocky creek-beds in recently upheaved limestone country, where they were found in great numbers near the stagnant pools. In Normanby Island a new species of *Phasmide* (stick insect) was found. That so large a proportion of novelties as eight conspicuous butterflies, out of a total of nineteen species collected while on a hurried journey undertaken with other objects in view, sufficiently indicates the richness of the d'Entrecasteaux fauna, and the desirability of its being systematically investigated.

Among the Coleoptera one of the most remarkable was the *Tricondyla aptera*, a scaly monster more than four inches long, which we found

[1] Given the condition that the bird existed on either side of the deep strait, it is not surprising, after Wallace's researches, that it has not crossed the strait; but why it should be found in the islands and not on the mainland, where the conditions of existence are at least equal, it is difficult to conjecture.

both at Rossel Island and Fergusson, eating its black tunnel into the very heart of the young trees. Rossel Island is not rich in Coleoptera. Though we examined a number of decayed trees, and set traps, we succeeded in securing only two species, both novelties—a *Lachnosterna* and a *Lepidiota*. Perhaps the most beautiful of our specimens was the *Œsernia splendens*, which we secured in Normanby Island. Among the novelties from the d'Entrecasteaux Islands were a *Pachyrynchus* and an *Apirocalus*.

Snakes are very numerous in both groups of islands, but among the few we succeeded in capturing there were no novelties, and they were common to both the Louisiade and d'Entrecasteaux. The handsome *Dendrophis calligaster* was most commonly met with. Alligators swarmed in the saline pools near the shore, and the tracks of very large ones could be seen every morning leading from the pool to the sea. We even saw them floating motionless in the sea nearly a mile from shore. Among the reptiles we secured a specimen of the large black lizard, *Varanus kordensis* (Mayer), in Normanby Island, thus extending the range of the species, which is only recorded from Mysore and the Aru Islands. A frog—*Cornufer corrugatus* (Dunn)—was met with in Sudest Island at an altitude of about 2000 feet. The mammalia of the d'Entrecasteaux include two wallaby and two opossums. The black wallaby found there has not yet been compared with the black wallaby of eastern New Guinea.

The mammalia of the Louisiades are few in number. We found two species of opossum and a fruit-eating bat. The rat—*Uromys Cervinipes* (Gould)—exists in large numbers in Rossel Island, and the natives protect their houses against them by means of a wooden plate fitted on the top of each supporting post over which the rats cannot climb. In Goodenough Island we noticed large numbers of the bat—*Harpyia major* (Dobs). The long protruding nostrils give the head a most curious appearance. The mammalia of the d'Entrecasteaux include the small brown wallaby and the black wood-wallaby, which is found in the forests of the east end of New Guinea.

But the most interesting feature of the fauna of the Louisiades is to be found in the land- and fresh-water shells. Our collection consisted of seven species of *Helicidæ*, two *Helicinæ*, four species of *Pupininæ*, a *Pythia*, eight *Neritinæ*, and a *Melania*. The geographical range of land molluscs being so limited, it is not remarkable that, out of a total of fourteen, ten species are new. None of the fresh-water shells, on the contrary, are restricted to these islands. The four species of *Pupininæ*, all from Rossel Island, show in a remarkable manner what gradual modifications exist in the labral slit of the genus Pupinella. One of them—*P. miranda*, n. sp., has a curious modification of the radula, which enables respiration to continue after the operculum has closed the mouth of the shell.

Up to the present time fifteen species of land-shells have been recorded from the Louisiades. With our collection therefore, and three species collected by Macgillivray during the voyage of the *Rattlesnake*, the total of species known to inhabit these islands is twenty-nine, probably considerably less than are really to be found there. The insects, reptiles, and shells recorded above are now in the Natural History Department of

the British Museum, and descriptions of the new species will appear in the *Annals and Magazine of Natural History.*

The fauna and flora of these islands are full of interest, and this expedition has only served to show how desirable it is that they should be systematically examined. In a hurried visit such as ours it is the more remarkable objects that attract attention, while the commoner and less striking pass unnoticed. Zoology bears out the inference gathered from the geological formation that the islands have undergone great physical changes, but the limited area of some species and the extended range of others require a very careful investigation.

THE PRESENT AND FUTURE OF QUEENSLAND.

(*Read at Meeting of British Association*, 1889.)

By Carl Lumholtz, M.A.,

Member of the Royal Society of Sciences of Norway.

I may begin this paper by reminding you that Queensland, one of the youngest of your colonies, is three times as large in territorial area as France, and about six times as large as the United Kingdom. I would also ask my hearers to couple with this the fact that this immense territory, which, in December 1859, by its separation from New South Wales, became an independent colony, when it had a population of 25,000, is, according to the last census, only now populated by 366,940 souls. The popular idea of Australia is mostly confined to gum trees and kangaroos; it is supposed to be a place where there are sheep and cattle on a thousand hills, and where lucky diggers amass immense fortunes in gold-mining.

What is called the romance of colonisation may be very well worked out by a description of the manner in which this colony was formed. Its capital, as everybody knows, is the city of Brisbane; and there are probably among my hearers men who can remember the rough-and-ready settlement of Moreton Bay at the time when the Moreton colony became independent. This city is now growing by leaps and bounds, and its population has during the last ten years more than doubled. The history of Brisbane is, in short, the history of all Australian cities. Mere shanties of boards and shingle have given place to palatial buildings of stone, and, one by one, all memories of the old convict days have departed; so that a traveller landing in Brisbane to-day will find himself in a city of which no nation need be ashamed. The Moreton Bay district, and the Wide Bay district, which were the first to be settled, are so well known that I need not take up your time with any description of them. It is a matter of history how the fertile Darling Downs, 2000 feet above the level of the sea, became occupied in 1842, and how the march of settlement proceeded northwards, creating the ports of Maryborough, Gladstone, Mackay, Rockhampton, Bowen, Townsville, and

Cooktown. Nor need I here enter into the question as to whether by and by the North will separate from the South; whether Rockhampton or Townsville will be the capital; and whether on some future day there will be a Northern Queensland devoted to tropical agriculture, with coolie labour, localised and recognised. The colonisation of Queensland began, as is always the case, along the coast, where the people have the advantage of fine harbours and navigable rivers; but the adventurous squatter—boldly acting upon the reports of explorers like Oxly, Cunningham, Mitchell, Leichhardt, Kennedy, Landsborough, and Walker—selected runs in the western interior, which it had been the custom to regard as a terrible desert, but which was found to be pastures of the richest description. There were the usual rushes here and there for gold fields. Gradually sugar-planting became a remunerative industry; and so with its minerals, cattle, sheep, and agriculture, the prosperity of the Colony was assured. For many years, however, the northern part of Queensland was an unknown land, spoken of as uninhabitable on account of the tropical heat, and as the haunt of the aborigines, who here were very numerous.

I may here explain that although the great want of Queensland is a perpetual supply of water, there are some fine rivers; and these are to a large extent due to the physical formation of the country. Running more or less parallel with the eastern coast is a backbone of hills known as the *Great Dividing Range*. This extends parallel with the coast, at distances varying from fifty to two hundred miles inland, and forms, as a rule, the watershed between the eastern and western waters. The summits of this range—although one of these, the Bellenden Ker, rises to a height of 5260 feet above the sea—are not so high as the Southern Australian mountains; but this range, by throwing off rain, and creating such large streams as the Fitzroy and the Burdekin rivers, naturally makes the eastern part of Queensland more fertile for agricultural purposes than the great western plains. These, although they in the Spring present a fresh and green appearance, suffer during the greater part of the year from want of rain, but provide the finest pastures imaginable.

In the western plains the yearly rainfall measures only 10 to 30 inches; but on the southern part of the coast it may be 60, and on the northern part it must average as much as double. In one year, in 1886, it amounted at Johnstown river (18° S. lat.) to 170, while at Aramak (22° S. lat., and in the same long.) it measured 22 inches. Aramak is 265 miles from the coast.

I propose, with this brief introduction of the salient points of Queensland geography, to talk not about the more well-settled districts in which the population is numerous on the eastern side of the Dividing Range, but about the much less known downs of the west, towards which settlement is gradually but surely creeping; and of the wilder north, where I had, I think I may say, the unique experience of living for about a year among the aborigines of Australia. I presume you all have some knowledge of the general products and of the statistics of Queensland, and it will not, therefore, be necessary for me to explain in detail the almost boundless resources of the country, its mineral wealth, especially of gold,

silver, copper, tin, antimony, and mercury. I must, however, say a few words about two of the most celebrated mines out there. One of these, the famous mine at Cloncurry, has, besides its wonderful wealth of gold and copper, mountains of pure iron ore. One of these is 200 feet high, but this colossal mass of iron is almost worthless, on account of its geographical position. The other mine—at Mount Morgan—has made Queensland the greatest gold-producing colony in Australia. This mine was discovered in 1884, and is now probably the richest of any in the whole world.

It is also a remarkable fact that the gold here appears in an entirely new form. Mount Morgan, which is about 300 feet high, has, according to Mr. Jack, the Australian geologist, been produced in the Tertiary Period by a hot spring, which may have resembled Iceland's geysers or the hot springs of Yellowstone Park. It is formed of siliceous sinter, with some limonite and clayey substances, and the gold is distributed throughout the rocky mass. This discovery has made the owners immensely rich, the value of some of the original shares exceeding one and a half million pounds. One of my friends who bought a share for £1000 has now made out of this an income of more than £2000 a year. By boring it has been demonstrated that the gold increases in quantity with the depth, so that there seems to be no end of this fabulous wealth. No wonder that it has attracted the attention of speculators in every part of the world. At the present time the weekly output of ore is 1500 tons. The average yield is 6 ounces per ton, and accordingly £36,000 of pure gold is produced per week. This great find of gold is interesting, both from a theoretical and from a practical point of view. It shows that gold-bearing siliceous sinter can be the result of volcanic agencies, and that there is a hope that gold may yet be found in formations that have hitherto been regarded as worthless.

The most important source of tin-lode in Australia is found in Queensland in the Herberton tin mines.

Some present may remember that the exhibits at the Indian and Colonial Exhibition (1886), in London, showed that even such marketable stones as opals are found in fair quality and good quantity. My own impression is that coal will prove to be one of the most valuable products of Queensland in the future. At present there are only two or three fields which are being worked, but the coal of the Ipswich district has been reported upon by engineers as being quite as good as the coals found at Newcastle in New South Wales. The Burrum-Burrum mine between Maryborough and the coast gives us the promise of a good and extensive field. At present, however, this is a source of wealth that requires further development. But the Queenslanders seem to believe in their coal-fields, as they a few months ago sought from the Government a duty on foreign coal to protect their own until the means of development have been improved. The time is not far off when coals will be exported from Queensland just as much as coals at present are exported from Newcastle in New South Wales, where scores of large steamers may be seen loading at one time. The mechanical means of loading are most efficient.

The grasses of Queensland are very nutritive, such as the kangaroo

grass, the blue grass, and above all the Mitchell grass, which has a remarkable power of enduring droughts, the least rain causing the apparently dry stalks to shoot. Of 360 kinds of grasses in Australia about three-fourths are found in Queensland. In useful woods, both hard and soft, Queensland is unusually rich. There are in all about 200 different sorts that may be useful.

The climate of Queensland, although very hot, is very healthy on account of its dryness, which makes the heat less oppressive. In the winter the sunny days and the clear nights for weeks and months together create the perfection of climate. It is remarkably healthy, and many an instance is recorded of consumptives who have been sent away from the old country, and from the other colonies, as it was supposed, to die, recovering their health.

European grains and fruits, such as apples, pears, and strawberries, can be grown upon the highlands, while semi-tropical and tropical fruits flourish in luxuriance in the low-lying districts on the coast. Oranges, mangoes, guavas, loquats, pine-apples, bananas are to be seen in almost every garden. The vineyards of Roma produce grapes equal to those grown in any part of the world. There are, however, very few *indigenous* fruits. During my whole stay in Australia I only once found a really delicious *indigenous* fruit—a kind of yellow half-transparent fig. The blacks found it for me in the scrubs; but it was so rare that I never met with it any more. Those fruits that have been introduced, however, abound and thrive wonderfully well.

The principal product of agriculture is maize, but wheat and oats can also be grown, though probably with not so much success as in South Australia and Victoria. The capabilities of Queensland in the matter of agriculture are almost beyond conception, but these will not be fully developed until an artificial system of irrigation has been established. Queensland, like all the other Australian colonies, suffers from the capricious alternation of droughts and floods, but the colonists are becoming alive to the importance of a water-supply somewhat on the principle of the tank system in India, and I find a vigorous system of experiments with artesian wells being made. On a journey extending over some months which I made to the Diamantina River in Western Queensland the idea forced itself upon me, day after day as I rode over magnificent open downs many feet deep with virgin soil, chocolate or black in colour, that there is a splendid future in store for coming generations, when they have called in the aid of science to supply the water which nature has so begrudged them. If we see what Darling Downs have done for Brisbane, what may not the vast open downs north of Darling Downs do for the whole of the eastern coast, when they have been fully developed by artificial means? I was very glad to learn that in 1888 water was found on the Barcaldine Downs by means of artesian wells at a depth of 691 feet; it was clear as crystal and perfectly fresh; but it was very warm, the temperature being at first 120 degrees Fahr., but afterwards cooling down to 101 degrees. The water issued from a pipe of 10 inches in diameter with such a force, that it carried up to the surface stones of the size of emu eggs. The amount of

water obtained from this artesian well was about 176,000 gallons per day. Other experiments of a similar nature have been carried out with success; and as a further example of what can be done, I may state that at Blackall in 1888 an artesian well was struck at 1663¼ feet, giving out water at the rate of 300,000 gallons per day, of a temperature of 119 degrees. In other places several borings have been successful at a very shallow depth.

The most interesting portion of my residence in Australia, where I was sent by the University of Christiania to study the fauna and the aborigines of the continent, was spent in the north-eastern district of Queensland close to the coast. Here I remained fourteen months, constantly travelling and studying. The great cry of Australia is "Australia for the white man," and in Queensland I found that repressive measures had been taken by the legislature in response to public opinion, which demanded that the immigration of the Chinese should be checked, and the importation of kanakas from the South Sea Islands should be discouraged. Consequently, the immigration of Chinese and Polynesians has considerably decreased of late years. In 1883, 2951 Chinese immigrated to Queensland, while in 1887 there were only 307. The number of Polynesians arriving in Queensland in 1883 was 5276, and in 1887, 2079. This is a sore point with the Queensland colonists, the white working men in the southern portion strongly objecting to the cheap labour of the Chinese, kanakas, or coolies. The repressive measures to which I refer have had the effect of almost crippling the once flourishing sugar industry, and I have no doubt myself that, in the tropical portions of the colony, where sugar, tapioca, spices, cinchona, coffee, arrowroot, and probably tea may be profitably grown, coolie labour will, in the future, be largely employed; for although it is possible for white men to work in the open air at all periods of the year, as a matter of fact the cultivation of sugar-cane is not a work in which they are willing to engage. India is only twenty days' sail from the north of Queensland, and sugar-growers are looking forward to the time when the surplus labour of the Indian dependency will be encouraged upon sugar and perhaps cotton plantations. I may here say that the general opinion is, that sugar will also be grown round the shores of the Gulf of Carpentaria.

My principal studies were confined to the unfortunate aborigines of the continent, said to be the most degraded and hopeless of all savage races. As I intimated just now, I lived amongst these people, adopting as far as I could their mode of life, and making myself acquainted with all their manners and customs. I camped with them in different districts, the only white man amongst them, and, as far as I know, the only white man with whom some of these tribes ever came into contact. I was able to study these savages, young and old, and was fortunate enough to collect for the science of Ethnology facts concerning them of which little or nothing hitherto has been known. The Australian aborigines are rapidly disappearing, and probably within a generation or two they will, like the aborigines of Tasmania, have vanished altogether from the face of the earth. The base of my operations was the Herbert River, under 18° S. lat., and from my headquarters, Herbert Vale, I made

expeditions in various directions, extending, in some instances, to nearly 100 miles. Of the 50,000 natives that are supposed to be living in the whole of Australia, probably from 8000 to 10,000 inhabit this northern portion of Queensland, but all efforts to obtain correct returns as to the numbers of these people have been unavailing. I could not of course go at once to live with them, but had to work my way carefully, having during the previous year, in the more settled districts of the colony, acquired some experience as to how to deal with them. The natives living immediately round my headquarters at Herbert Vale were partly civilised, and I accompanied them on their hunting expeditions, witnessed their fights and dances, and grew familiar with their language and customs until I felt I could venture further inland to mingle with the real savages. I need not say that great were the difficulties and even dangers in my path, but luckily I had a large supply of tobacco, which was the only means by which I was able to pay and conciliate my naked friends. Every night by firing off my revolver before I retired to rest, I kept alive in their minds the impression that I had the means of defence with me. I used to live in huts the same as those used by the natives, and which could be built up in a few minutes from boughs of trees and palm-leaves. I had my hut made so long that I could stretch myself at full length, while my people used to huddle together two or three in a hut, in order to keep themselves warm, their feet projecting outside the opening. Although I lived on terms of perfect friendship with them, I never gained their gratitude, but found that when the novelty had worn away their friendship decreased; and at last they were evidently only waiting for an opportunity to take my life. That I was able to take my leave of them without a breach of the peace, and as a living man, I deem an especial piece of good fortune.

During my travels I was fortunate enough to find a really good black fellow of the northern tribes, who stuck to me wherever I went. My general plan was to form a camp at the foot of the mountains, leaving the horses behind hobbled; to place the saddles and bridles in a tree, so that the dingoes (the Australian dog) could not get at them; and then ascend the mountain on foot, pushing through the dense underwood, and carrying a small supply of ox flesh and wheat flour for provisions. When this store was exhausted—which occurred very soon—I lived, like the aborigines, on snakes, lizards, larvæ, eggs, etc. The most important item of all my outfit, however, was tobacco, of which the aborigines are inordinately fond. They would accept it as money, and exchange even their wives and daughters for it. These tribes would often send to distant tribes small bits of tobacco wrapped up in gum leaves, or grass, as recognised objects of barter. It is remarkable that in this way the use of tobacco has been known among tribes who have never themselves come into contact with Europeans.

It struck me that the aborigines with whom I thus mingled on the Herbert River were a very mixed race of people, physically, for while some were tall and well shaped, there were others of a smaller and weaker stature. Nearly all had the ordinary flat, triangular noses, but I found several with almost Roman noses, indicating an interbreeding

with the Papuans, who, it is well known, are very proud of their prominent noses. There is no kind of cohesion among these people, for they are divided into a number of tribes, and their languages appear to be as diverse as themselves; though on closer examination it appears that all the languages are in some measure related to one another, so that they may properly be styled dialects derived from one common source. Of a written language there is no trace; nor do these aborigines cultivate the ground, or keep any domestic animals except an occasional dingo.

They have no instruments or weapons better than the rude axe, tomahawk, boomerang, spear, club, wooden swords, and shields; the boomerang is not used further north than the Herbert River, the dense scrubs which exist as one gets further north rendering useless a weapon that requires a clear space of 100 yards for operations. The black fellows almost exclusively use spears in hunting on the grass lands, but when they are walking in the extensive and thick brushwoods of the north, they move about perfectly unarmed. If they get a glimpse of any animal, they break off sticks, and try to kill the animal by throwing sticks or stones at it. Herein they generally succeed, as most of the animals live in trees, and have great difficulty in escaping when the natives from several sides climb up and encircle them. When an animal has been slain, and is to be prepared for food, the belly is opened by the first stone or piece of wood found suitable for the purpose. The game is divided for distribution either with a stone, or with the teeth, which are also largely used for breaking off limbs of trees, and for making implements. The knives used by the blacks are either pieces of stones found ready for use, or they are secured by breaking pieces off the rocks, little additional labour being bestowed upon them. The Australian native is, in reality, not very far advanced in the Stone Age.

The mutual relationship of the different tribes is still, on the whole, that of the lowest grade of the human race. They are polygamists, and a man's riches are judged by the number of his wives, who have to do most of the work. I found no chiefs among the tribes on Herbert River. They have no religion, and they acknowledge no discipline; personal liberty is never interfered with; they, in short, roam the forests, climb the mountains, and live from hand to mouth upon roots and such live creatures as they can kill: perfect types of the wild children of nature.

They are fairly kind among themselves, hostile to strangers, and given not only to killing but to eating their enemies. Of this there is no doubt whatever. I do not say that all tribes of Australian aborigines are cannibals, but in the north they make no secret of it; and this is a fact well known to the white settlers. One of the standing themes of conversation among my people around the camp-fire, was how best to procure *talgoro*, or human flesh; and there was one old woman who had quite a reputation on account of her cleverness in procuring, with the aid of her husband, that very much coveted delicacy. It must not be supposed, however, that the aborigines indulge in human flesh every day. They like it as a matter of preference, thinking it better meat than the flesh of the wallaby or the snake. It is their tit-bit, and they have an

idea that by eating the fat round the human kidneys they will be invested with the strength of the dead man. They are also fond of carrying little bits of human fat wrapped up in grass, in one of their baskets slung round their necks, believing that such a talisman will ensure them good luck in their hunting expeditions. It was, during the latter portion of my sojourn, a consolation to know that my friends had a strong dislike to the flesh of white men, declaring that it gave them nausea. They prefer the flesh of people of their own colour; and it was pretty certain that, though my life might be treacherously taken, I should not be served up for a meal. It had been arranged that I was to be quietly dropped into the river. It is not because they would like to eat you that they are dangerous to associate with, but because they want to possess what you have. A black fellow will kill a white man for a pipe of tobacco. It is not often that an opportunity presents itself to obtain *talgoro*; during my whole stay at Herbert River only two blacks were killed and eaten. One was a young man who had ventured into the territory of another tribe; the other an old man who was not able to escape quickly enough when his tribe was attacked, and so he was beaten to death with stones, and his flesh was brought to Herbert Vale in baskets.

On the whole I agree with those who think that the Australian blacks cannot live under civilisation; they will not give up their old nomadic life; they seem doomed to adopt, not the virtues and advantages, but only the vices and evils of civilisation: within not very many years a whole race of people will have succumbed to the inexorable fate of hopeless extinction.

Some of the aboriginals have been sufficiently civilised to make good shepherds or stock-riders, or be formed into "native police" (and the latter, of course, are the natural enemies of those against whom they are used). But although the Australian native may advance so far in civilisation as this, it is a characteristic fact that he can never get into an independent position. He never lays anything aside for future use, and does not know how to "make money." He never learns how to become a trader; and he retains, when civilised, the decided disinclination for farming, so characteristic of him in his natural condition. Not even in the easily-earned income that may be derived from grazing does he understand his own interests. A living sheep is an impossibility in the camp of the blacks; they would most assuredly eat it at once; the gold of the country is for them nothing more than a stone, even if they see the greedy digger grow rich by the search of this precious metal. Therefore, on the whole, it is impossible to resist the conclusion, that any advance in civilisation is beyond their power; and that they will remain without future, without hope, without home—in other words, they are a doomed people.

The well-appointed agencies of the various colonies in London, the exhaustive information furnished by the literature that arose out of the Indian and Colonial Exhibition, and by private individuals such as Mr. Bonwick, Mr. Bailey, and others, and by the articles in the valuable weekly newspaper *The Queenslander*, will have given much information

with regard to the progress made in Queensland as well as in other colonies, with regard to railroads, harbours, electric telegraphs, and other practical works undertaken by the respective Governments. The history of Queensland, the youngest of the Australian colonies, like the history of the others, has been to establish communities which possess the vigour of youth and European culture combined. It is very marvellous that these results have been achieved in two generations; and if we could visit Australia two generations hence we should probably find a country where not only European flora and fauna have invaded and conquered large districts from which they have been excluded since the Tertiary Period, but where every trace of the original population will have disappeared. Instead of the stagnation of the first stages of the Stone Age we shall have a vigorous development parallel with the culture of Europe and America.

A comparison of the following figures is instructive:—

Revenue	for 1878, . .	£1,559,111.
Do.	for 1888, . .	£3,177,518.
Expenditure	for 1878, . .	£1,566,722.
Do.	for 1888, . .	£3,368,883.

The colonial debt of Queensland, which is heavy for the present population, has been chiefly expended in Government railways, which are opening up the country and its resources. It is also noteworthy that the mercantile marine of the colony has developed to a marvellous degree. In the whole history of man a more sudden revolution has not been known than that which has happened in Australia during this century; and Queensland with its wool and cattle, its semi-tropical and tropical riches, with its ability to produce sugar of high quality in any quantity, with its extraordinary yield of precious minerals, such as that which makes the Mount Morgan mines one of the wonders of the world, apart from the hopeful character of its coal-fields, with its sea-board of 2500 miles, its good harbours, its healthy climate, its free education, and the many free institutions for the benefit of its people, is nobly fulfilling the aspirations which have made the Anglo-Saxon the most successful colonists in all ages, and justifying the most sanguine hopes of the pioneers of Australian colonisation.

THE PHYSICAL CONDITIONS OF BARENTS SEA.

By Professor H. Mohn, of Christiania.

That portion of the ocean between Norway, Bear Island, Spitzbergen, Novaia Zemlia, and Russia is called by the Norwegians the *East Sea*. It is otherwise christened by other nations. Our neighbours, the Russians, call it the *Murman Sea*, a name signifying the Norman Sea. The name now mostly used in geographical literature is *Barents Sea*, after

the illustrious Dutch seaman who discovered Spitzbergen, and died in the year 1597.

Barents Sea has been investigated by Norwegian, Swedish, Dutch, French, Austrian, German, and Russian expeditions. The seal-hunters and the Archangel traders of different nationalities have shared in these investigations. The depths of the Barents Sea contrast in a marked degree with those of the Norwegian and Greenland Seas. Between Jan Mayen and Norway, and between Greenland and Spitzbergen, there are depths of upward of 2000 fathoms, but the bottom of the Barents Sea is found at depths under 300 fathoms. The transition from the great depths in the western part of the Northern Ocean to the shallows of the Barents Sea is marked by an imaginary line drawn between Western Spitzbergen and Tromsö. Here is a submarine plateau, having on its western wall a steep declivity towards the depths of the Northern Ocean, and on its eastern wall a relatively flat sea-bottom rising slowly towards the coasts of Norway, Russia, Novaia Zemlia, and Spitzbergen, and continuing towards the north-east, with only 100 fathoms of water, to between Spitzbergen and Novaia Zemlia. The adjacent Siberian Sea is also characterised by slight depths.

The Barents Sea is therefore deepest in its western part. A depression of upwards of 200 fathoms in depths projects from here into the middle of the sea eastwards as far as the longitude of Vardö, the part of the bottom lying further east having depths varying between 200 and 100 fathoms, but more generally averaging the latter. The hundred-fathom line runs very near the Norwegian coast; here the bottom consequently descends rather quickly from the coast-line. But from Kola, on the Murman coast, the 100-fathom line stretches direct to Novaia Zemlia, and continues in a sinuous direction to the north of this twin island. Further on we find it again in higher latitudes. It encloses Bear Island, and reaches the banks of Western Spitzbergen. On the eastern plain of the Barents Sea, where the depths are mostly a little over 100 fathoms, are found some slight elevations and depressions; the form of the sea-bottom is slightly undulating.

The fjords of Finmarken do not present such depths as do the fjords of the west coast of Norway. In the Alten Fjord and in the Varanger Fjord we have sounded upwards of 200 fathoms. The Porsanger Fjord has at its mouth 127 fathoms, and in its inner part, by Kistrand, only 90 fathoms. Of the inner parts of the Laxe Fjord and the Tana Fjord we possess no soundings. At their mouths we have reached 145 and 127 fathoms respectively.

As regards the material deposited on the bottom of the Barents Sea, we have acquired some knowledge from the researches of the Norwegian North Atlantic Expedition. The route taken by the expedition was from Tromsö to Alten Fjord, Hammerfest, the mouth of Porsanger Fjord, and of Tana Fjord, to Vardö; and from that place at first towards the north-east, then westwards to Bear Island, and back to Hammerfest. The specimens of the deposits obtained at the different sounding stations have been analysed by our chemist, Mr. Schmelck. They consist of a peculiar sort of clay, different in description from that lying on the bottom of the

deep Northern Ocean. Its chief constituent is silica (quartz); it is very poor in carbonate of lime, and is characterised by the existence in it of the shells of a small animal belonging to the *Foraminifera*, from which our zoologists have given it the name of the *Rhabdammina* clay. Its colour is dark green. It is probable that this material is derived from the quartz rocks of the surrounding countries, which, by means of the rivers, tides, currents, and drift-ice, have been spread over the sea-bottom.

The salinity of the water of Barents Sea is slightly lower than that of the Norwegian Sea, particularly at the surface. The bottom waters of the two seas are almost equally salt. The saltest water lies in the form of a tongue, striking roughly from west to east, along the middle of the sea between Bear Island and Norway, and reaching a little past the meridian of Vardö. Near the coasts the salinity decreases, as is the case also in the Oceans. In the southern part the sea-water, particularly the upper layers, is impregnated by the water from the great rivers in Finmarken and Northern Russia; in the eastern and northern part by the melting of the ice masses encircling the west coast of Novaia Zemlia and the east coast of Spitzbergen, and of those drifting down from the Siberian Sea, and filling the surface as far as past Bear Island.

The temperature of the water in the Barents Sea exhibits some contrast in its southern and its northern part. The mean annual temperature of the surface is 5° C. at the North Cape, 4° C. on the Murman coast, from 2° to 1° C. on the west coast of Novaia Zemlia, and 1° C. at Bear Island. In the month of August, the warmest for surface temperatures, the normal temperature of the sea is 9° C. at Söröen (Hammerfest), 8° to 6°, and lower on the Murman coast, 5° to 1° at Novaia Zemlia, 2° at Bear Island, and 1° at the South Cape of Spitzbergen. In March, the coldest month for surface temperatures, the temperature of the sea is 2°·4 C. at the North Cape, 1°·4 at Vardö, 0 °to −2° at Novaia Zemlia, a little above 0° at Bear Island, and 1° at the South Cape of Spitzbergen. For the whole year, as well as for the warmest and the coldest months, the surface water is consequently warmest at the coast of Finmarken, and coldest in the sea between Novaia Zemlia and Spitzbergen. A tongue of warm water projects eastwards along the coast of Finmarken and the Murman coast, and a tongue of cold water southwards, east of Spitzbergen, down to Bear Island. The situation and the direction of these tongues mark the path of the warm and the cold oceanic currents in the Barents Sea.

At the depth of 100 fathoms we have 4° C. off Hammerfest, 3° off the Tana Fjord, 2° off the Fisher Peninsula (Rybatschi Ostrow), 1° off Kola, and 0° along a line running south to north from the 70th to the 75th parallels of latitude, and east to west along the last-named parallel. Similar curves show the other isotherms for 1° to 4°. In the above-named bay, bordered by the 200-fathom line, are found temperatures of from 1° to 3° above zero.

At the sea-bottom, irrespective of its depth, the temperature is distributed in the following degrees. Off and near the coast of Finmarken it is upwards of 4° from Vardö to off Hammerfest, and 5° further west. From here the temperature decreases towards the east and towards the

north. A somewhat sinuous line drawn from the South Cape of Spitzbergen to the White Sea along the sea-bottom marks the temperature of 0°. Towards the south and west of this line the temperature of the water at the bottom is above 0°, towards the east and north it is below 0°. The ice-cold water thus held within bounds does not establish any connection with the ice-cold water of the deep Norwegian Sea south of Spitzbergen.

The distribution of temperature here described is the normal, so far as I have been able to determine it. In the course of several years there will be deviations from the normal temperatures which, so far as we know, may become very considerable. The Barents Sea is a *shallow* one, where the atmospheric influences can make themselves felt as far down to the very bottom.

From the fjords of Finmarken we have observations that go far to show that the temperature at the same depth is not the same from year to year. In the Alten Fjord I found, in July 1873, at a depth of 100 fathoms, 4°·0 C., and a bottom temperature in 200 fathoms of 3°·3. At the end of June 1878 we found, on the North Atlantic Expedition, 2°·6 C. at 100 fathoms, and 4°·0 at 200 fathoms. A little further in we found, the same day, 3°·9 at a depth of 89 fathoms. The Norwegian Polar Station at Bossekop registered during the Polar year 1882-3, in the Alten Fjord, from observations taken every month, a temperature at 100 fathoms varying from 5°·2 to 4°·5. I have tried, but in vain, to trace the connection between these variations of the temperature of the deep sea, and the temperature of the atmosphere over the fjord. They must be due to currents in the sea carrying the temperatures with them from a distant warmer or colder region.

In the Varanger Fjord, in August 1875, I found off Bög Fjord, in one of the deepest parts of the fjord, at 100 fathoms, a temperature of 2°·6, and at the bottom in 224 fathoms, 3°·1. In the summer of 1876, with the same ship, the surveying steamer *Hansteen*, there was found in another depression of the sea-bed, south of Vardö, at 237 fathoms a temperature of 5°·7. In the summer of 1881 the French Expedition on board the *Coligny*, Captain Martial, with Professor Pouchet as scientific leader, found in the Varanger Fjord much lower temperatures, viz., 1°·5 at 100 fathoms, and only 1°·3 at 200 fathoms. These last observations show to what an extent the water of the Varanger Fjord can be cooled down after a strong winter. From October 1880 to June 1881 the temperature of the air at Vardö was constantly as much as 2°·5 to 4° *below* the normal, and during the spring months large masses of ice-floes were drifting off the coast of Finmark. Near Tromsö an iceberg was found stranded at the same time.

The current runs in the Barents Sea as a rule along the coast of Finmarken and the Murman coast eastwards, in the eastern part of the sea northwards, and in the northern part, between Novaia Zemlia and Spitzbergen, westward. Along the east coast of Spitzbergen the current sets southwards. The warm Atlantic current, a branch of the Gulf Stream (this name being taken in its widest sense) runs along the coast of Finmarken, curves on leaving the Murman coast towards the north, and turns then to the west towards Bear Island. It fills the sea down to the bottom

with its temperate water. This is warmest in the southern branch running eastwards; and it becomes by and by, further on, cooled down by the neighbouring ice-cold water with which it mixes, and which from the northern regions is driven southwards and westwards. The surface of the sea between Spitzbergen and Novaia Zemlia is always covered with drifting ice.

The cause of these currents I attribute to the prevailing winds, their direction and force, in connection with the distribution of the density of the sea-water. The prevailing winds for the year are in the southern part of the Barents Sea south-westerly, in the eastern part southerly, and in the northern part easterly and north-easterly. They carry the surface waters with them, and this effect is communicated to the deeper layers, as a rule, quite to the bottom in this relatively shallow sea. The water, being less salt, and therefore of a lesser density at the coasts and in those localities where ice is melting than in the open sea, the level of the surface becomes higher at the first-named places than in the middle regions, and this gives rise to a movement quite in accordance with that arising from the prevailing winds. The principle is the same as that expressing the relation between the wind and the distribution of atmospheric pressure in meteorology.

In the same manner as the temperature in the sea changes with the seasons and from one year to another, so do also the currents which are the bearers of the temperature. There has not yet been amassed any material for a detailed study of the variations of the currents. Not until observations of the currents are made can we think of investigating the connection existing between the fluctuations of the atmosphere and the discharge of the rivers on the one hand, and the currents of the sea on the other.

The larger animals in the sea being the objects of capture, live on smaller animals. The development and presence of these small organisms is greatly dependent on the temperature of the water. But their presence in a certain place, and to a certain time, depends upon the oceanic currents, these being as a rule so strong, and the locomotive powers of the small animals so small, that these must follow the movements of the currents. The animals living at or on the bottom get their food brought to them by means of the currents.

The larger animals which are captured live, due exception being made for the season of breeding, in the places where they find their food. In the same manner, as this is dependent on the currents of the ocean, the nature of the currents becomes the condition for the subsistence of the larger animals.

That branch of the fishery investigations comprising the study of the habitats and the migrations of marine animals, must consequently take up, as one of its chief problems, the solution of the nature of the ocean currents—their direction, their rate, the temperature of the water, its salinity, and its contents of living organisms. These investigations must be directed in a physical, a chemical, and a biological sense.

Such investigations can be made with the technical and scientific means of the present day. For the work at sea a steamship is required,

fitted out with the necessary sounding apparatus, thermometers, areometers, zoological capturing gear, etc., not to mention accurate compasses and logging machines for the exact determination of the direction and rate of the currents. For the physical, chemical, and biological researches on shore, as well as for the working up of the observations collected at sea and on shore, there is required a special board or commission, with a laboratory and scientifically trained workers.

To a country like Norway, with its extended and rich home fisheries, such an institution would be an immense benefit. It would cost much money, of course, but there is no short cut conducting to the goal. Theoretical speculations based upon chance and one-sided observations may be interesting, but do not always point in the true direction.

The Barents Sea, with its fisheries, is an interesting field for investigation. Imagine what it would mean to the hard-working fishermen if the near approach to the land or the habitat of the fish could be predicted beforehand. What advantages has not the telegraph added by flashing instantaneous messages regarding the arrival of the fish, in place of the slow and inadequate means of reporting from the fishing-stations as in former days! Why should not an investigation of the fishing-grounds, systematically planned and carried out, by means of the telegraph, in future warn the fishermen where to find and to await the migrations of the shoals of fish? What modern meteorology, a science scarcely thirty years old, has achieved in the way of giving warning of storms to seamen and of weather to agriculturists, is only a beginning; but it leads one to hope that a duly organised institution for the investigation of the sea bordering our coasts, at some not very remote future, could do something like this for our fisheries. For the movements and changes in the Ocean are slow in comparison with the rapid motions and frequent fluctuations of the atmosphere.

ON THE ACHIEVEMENTS OF SCOTSMEN DURING THE NINETEENTH CENTURY IN THE FIELDS OF GEOGRAPHICAL EXPLORATION AND RESEARCH.

A REPORT TO THE PARIS GEOGRAPHICAL INTERNATIONAL CONGRESS OF 1889.

By Arthur Silva White, F.R.S.E.,

Secretary to the Royal Scottish Geographical Society.

(*Continued.*)

NORTH AND SOUTH AMERICA AND POLAR REGIONS.

The achievements of Scottish explorers in America and the Polar Regions are more concentrated the further we proceed north, until in Arctic America and the North Polar Regions they stand out in remarkable prominence. For the purposes of this Report, it will, therefore, be more

convenient to chronicle Scottish exploratory work in those regions under the one geographical division.

After the brilliant discoveries in America up to nearly the close of the sixteenth century, a long period of inaction set in. In North America, particularly in the Arctic regions of the continent, this torpor was dispelled by the action of the British Government in offering (1746) a reward of £20,000 for the discovery of the North-West Passage—in the attempt at which two hundred expeditions, exclusively British, are said to have set out. Of these only the most prominent, under Scottish leadership, can be mentioned here. At the same time, the officers of the Hudson Bay Company—which numbered many Scotsmen—were the pioneers of discovery in many of the interior parts of British North America.

Sir Alexander Mackenzie, who was the first European to cross the American continent from Ocean to Ocean, carried out two important expeditions towards the close of last century. In 1789 he started from Fort Chipewyan, on the northern shore of Lake Athabasca, and, reaching Great Slave Lake, passed down the river which now bears his name, to the Arctic Ocean. His second expedition (1792-3) was from the same starting-point. Proceeding up the Peace River, over the Rocky Mountains, he reached the coast of the Pacific opposite Queen Charlotte Islands, thus accomplishing the overland journey to which I have referred.

The earliest settlement in the great North-West was established by a Scotsman. This was the Selkirk or Red River Settlement, founded in 1811 by the Earl of Selkirk. The pioneers of this colony were almost exclusively composed of Scotsmen, four of whom were reported as living in 1887; incorporated in the province of Manitoba, the district is still a point of attraction to Scottish emigrants. Sir George Simpson (1792-1860), who, in his youth, was a *protégé* of the Earl of Selkirk, was for some forty years in the service of the Hudson Bay Company, whose affairs in British North America he superintended. He rendered great service to exploration: the Arctic expeditions of the Company were, I believe, whilst he held office, all planned and fitted out under his immediate direction. Robert Campbell discovered (1840) the upper course of the Yukon River, and, for a period of fifteen years, carried out important explorations, which opened up a number of new routes. Simon Fraser discovered (1806) the Fraser River, explored the Stewart River, and did other excellent work. Sir James E. Alexander spent seven years in exploring the forests of New Brunswick, the results of which he published (1849) in two volumes: *L'Acadie, or Seven Years' Explorations in British North America.* Between 1830 and 1831 he also made two exploring expeditions up the Essequibo and Mazaruni Rivers, in South America.

The Geological Survey of Canada was instituted by the Provincial Government in 1843, with the more immediate object of surveying the mineral wealth of the country. No extended systematic work had been previously undertaken. In the newer provinces, especially in the North and West, the geologists have perforce been their own pioneers, and have had to construct reconnaissance maps of the country. Thus, the Survey

has been largely geographical, and has considerably added to our topographical knowledge of the country. The greater number of those who have done the real work from the time of Logan (1842-3) up to the present year have either been Scotsmen or their immediate descendants. They may be briefly mentioned. Sir W. E. Logan was appointed provincial geologist in 1843, and held office till 1869. Up to the date of Sir W. Logan's resignation, about thirty-five annual reports were issued, the most important of which was the *Geology of Canada*, which summarised the results obtained by the Survey up to 1863. Dr. Dawson has carried out explorations on the mainland of British Columbia, in the Queen Charlotte Islands, from the Pacific coast to Manitoba by way of the Peace River, in the Rocky Mountains, and elsewhere. Dr. R. Bell has explored the country between Lake Superior and Hudson Bay, and has carried out explorations on the Lower Athabaska, Nelson and Churchill Rivers, the coast of Hudson Bay, and in other adjacent regions. Messrs. James Richardson and Walter M'Ouat have explored north of Lake St. John, in the vicinity of Mistassini Lake, and on the Rupert River. Mr. Andrew Lawson has worked on and in the neighbourhood of the Lake of the Woods. Other Scottish officers of the Survey, who also have done good work, have been Messrs. Alexander Murray, Charles Robb, Hugh Fletcher, Wallace Broad, Peter M'Kellar, Alexander Mackenzie, John Thorburn, R. Chalmers, and S. Cochrane.

At the end of last century a series of important scientific expeditions was commenced, the main incentive to which was the discovery of the North-West Passage. The British Admiralty itself took up the matter in the year 1818, and despatched Captain (afterwards Sir John) Ross in the *Alexander*, and Parry in the *Isabella*, in order to attempt a solution of the great problem. They made the circuit of Baffin Bay, ascending Lancaster Sound for some thirty miles, and returned the same season. Parry, more sanguine than his colleague, was intrusted by the Government with a commission in the following year, and succeeded in advancing 30° of longitude further west than any of his predecessors, and in showing the true direction in which the Passage was to be sought. The coast between Bering Strait and Point Turnagain (109° W. long.) being known, it was an important object to find some navigable passage between the latter point and Regent Inlet, to discover which Captain John Ross was again sent out in 1829. The expedition spent three winters away, exposed to great dangers amongst the ice, and reached lat. 74° N., and long. 90° W., but, owing to scarcity of provisions and the approach of another winter, returned to England in 1833. On this occasion Ross discovered the Boothia peninsula, and his nephew, Sir James Clark Ross, the second in command, located the North Magnetic Pole. Sir James Clark Ross served with distinction in all the expeditions, between the years 1818 and 1833, for the discovery of the North-West Passage. As I have mentioned, he discovered (1831) the North Magnetic Pole. In 1848 he made a voyage in the *Enterprise* to Baffin Bay in search of Sir John Franklin, but without success.

Between 1839 and 1843 Sir James Clark Ross commanded the famous expedition to the Antarctic Regions, which, in point of geo-

graphical discovery, transcended in importance all other expeditions to those regions.[1] He investigated important physical questions concerning terrestrial magnetism, and partly accomplished his chief object in locating the South Magnetic Pole. He earned the distinction of being the only man who has been so near to both Poles. The expedition, moreover, discovered the most southern known land in the world—Victoria Land, and its great volcano, Mount Erebus,—and attained the highest southern latitude ($78\frac{1}{4}^{\circ}$), or to within 700 miles of the Geographical Pole.

To return to the North-West Passage and the expeditions undertaken for its discovery. Sir John Richardson accompanied (1819) the discoverer of the Passage, Sir John Franklin, on his first Polar land expedition. From Great Slave Lake, he descended the Coppermine River, and explored the coast of North America as far as Cape Turnagain. Franklin, in his introduction to the *First North Polar Expedition*, gives Richardson the exclusive merit of whatever collections and observations were made in the department of Natural History. In Franklin's second expedition (1825-28), Richardson was intrusted with the exploration of the Arctic Sea between the Mackenzie and Coppermine Rivers—a distance of over 900 miles. These two expeditions resulted in "the exploration and delineation of the northern shore of the American continent throughout 40 degrees of longitude, comprising an extent of coast-line amounting to 2000 miles."[2] The magnetic and meteorological observations and the natural history collections were undertaken by Richardson, and were of high scientific value. In company with Dr. Rae, Richardson, in 1848, with the object of relieving Franklin, descended the Mackenzie River, and explored the shores from thence to the Coppermine River. Dr. John Rae, who entered the Hudson Bay Company's service in 1833, made very extensive journeys of exploration, and is distinguished for his sledge travels. During the five expeditions in which he was engaged, he traversed some 23,000 miles, over 1800 of which were new survey. As I have mentioned, he accompanied Sir John Richardson in the search for Franklin, in 1848. He carried out a similar expedition two years later on behalf of the Company. During one expedition (1853-54), to Repulse Bay, he discovered a new river which falls into Chesterfield Inlet, and, in the following Spring, his men were the first to ascertain the fate of Franklin and his followers. He had travelled 1100 miles when his party made this discovery, for which he received the Government reward of £10,000. In 1861, Rae made an expedition to the Red River and the Rocky Mountains. I should have mentioned that, as early as 1847, his discovery that Boothia was a peninsula of the American continent had an important bearing on the subsequent expeditions for the discovery of the North-West Passage.

[1] The expeditions to the Antarctic Regions have been:—Cook (1772-75); Bellinghausen (1819-21); D'Urville (1837-40); Wilkes (1838-42); and, finally, Ross (1839-43). The *Challenger* (the only *steam*-vessel to cross the Antarctic Circle), also made observations (1874) of depth, temperature, and the specific gravity of the sea in the neighbourhood of ice; but her stay was brief.

[2] *R. G. S. Proc.* vol. x. p. 200.

As in the Antarctic regions, so in the Arctic, a Scotsman commanded the expedition which attained the highest latitude, until Lockwood, of the United States Polar Expedition, under Greely, wrested this long-coveted distinction. I refer to SIR GEORGE NARES. He served as mate on board the *Resolute* in the Arctic Expedition of 1852-54, when he distinguished himself by his sledge travelling, and he commanded the Arctic Expedition of the *Alert* and *Discovery* (1875-76), when, as I have above indicated, Markham made his gallant attempt to reach the Pole over the Palæocrystic Sea, reaching latitude 83° 20′ 28″ N. Between 1872 and 1875, he commanded the famous expedition of H. M. S. *Challenger*. He also carried out (1878) a two years' survey in the South Pacific.

My chronicle of Scottish enterprise in the Arctic Regions would be imperfect without a reference to the Scottish whaling captains, whose great experience of ice-navigation has been so helpful to Arctic explorers. I cannot do better than quote, in this respect, the eulogy by General Greely, on the occasion of his address to the Royal Scottish Geographical Society:—"The Scotch whalers have pushed their vessels often into extraordinary latitudes, and have sometimes passed beyond the limits reached by other explorers. Several I know have passed in Smith Sound far beyond the 78th parallel, and gazed on the ice of those seas beyond the point reached by the ships of Baffin, Ross, Inglefield, or Hayes; and the record of one—CAPTAIN WALKER—was found by me on Littleton Island in 1881. The veteran whaler—CAPTAIN ADAMS—has, I learn, sailed further into some of the inlets of Lancaster Sound than any of his predecessors."[1]

BIBLIOGRAPHY: AMERICA AND POLAR REGIONS.

I have already mentioned in the above: SIR JAMES E. ALEXANDER'S *L'Acadie, or Seven Years' Exploration in British North America* (1849). SIR ALEXANDER MACKENZIE gave an account of his adventurous journeys in *Voyages through North America to the Frozen and Pacific Oceans* (1801), which contains a considerable amount of information in regard to native tribes, and is prefaced by an historical sketch of the Canadian fur-trade, in which he was engaged for a number of years at Fort Chipewyan. SIR JOHN ROSS published *Voyage of Discovery in the "Isabella" and "Alexander" to Baffin's Bay, and Probability of a North-West Passage* (1819) and *Residence in the Arctic Regions, etc., 1829-34*, with an appendix. SIR JOHN RICHARDSON'S works are of an important character. His great work, in two folio volumes, on the *Fauna Boreali-Americana* (1829-36) is a valuable contribution to science. He reported on the zoological results (fish and fossil remains) of the *Sulphur* (1843), *Samarang* (1848), and *Herald* (1852); and *On the Frozen Soil of North America* (1841). His explorations were given in *Narrative of a Journey to the Shores of the Polar Sea, 1819-22. Second Expedition, 1825-27, including an account of a Detachment to the Eastward* (1823-28). His journey with Dr. Rae, to which I have alluded, is chronicled in *Arctic Searching Expedition: A Boat Voyage*

[1] *Scottish Geographical Magazine*, vol. i. p. 598.

through Rupert's Land, etc. (1851). In addition to these he published, besides his article on *Polar Regions* in the *Encyclopædia Britannica* (1859) a general work entitled *The Polar Regions: Physical Geography and Ethnology of the Areas within the Polar Circle* (1861). Sir James Clark Ross recounts his remarkable expedition in *Voyages to the Antarctic Regions, 1839-43* (1847). Dr. John Rae has published *Narrative of an Expedition to the Shores of the Arctic Sea, 1846-47* (1850). Sir George Nares contributed to the published results of the voyage of the *Challenger* in *Reports on Ocean Soundings and Temperature* (1874-5). In 1876 he published his official Report on *The Last Arctic Expedition*, and a more popular account in *Voyage to the Polar Sea in the "Alert" and "Discovery"* (1878).

Alexander Wilson, a minor poet, will be remembered for his work on *American Ornithology*, the first volume of which appeared in 1808, the eighth and ninth volumes being edited after Wilson's death by George Ord. The traveller, Captain Basil Hall, whose journeys in Asia I have referred to, published (1822) *Extracts from a Journal written on the Coast of Chili, Peru, and Mexico in 1820*, which forms two of the earlier volumes of *Constable's Miscellany*, and a work on *Travels in North America* (1827-8?), which was violently attacked by the American press.

AUSTRALASIA, MALAYSIA, AND POLYNESIA.

The history of the exploration of Australia is to a large extent, as Mr. Favenc points out,[1] lost among the unpublished records of private travel: the pioneer squatter has played an important part in the discovery of the continent; and, though private individuals have done far more of the detail work, it is chiefly to the Government or public expeditions that we must look for our *data*. That Scotsmen have borne an important share in the exploration of Australasia, is evident from the Scottish names abounding on the map.

The first traveller I have to refer to is James Grant, who, in the year 1801, on board the *Lady Nelson*, was the first to pass through Bass' Strait and verify Bass' discovery of 1798. The following year, Lieutenant Murray, who succeeded James Grant in the *Lady Nelson*, continued the exploration of Bass' Strait, and made the important discovery of Port Phillip, which he also surveyed. Captain Stirling, who accompanied (1823) Oxley in discovering the Brisbane River, surveyed (1828) the coast from King George's Sound to the Swan River. Between the years 1817 and 1829, Allan Cunningham, the well-known botanist, conducted an important series of explorations. He was first (1817-20) associated with Captain King in the survey of the Australian coasts that had hitherto been unvisited. In 1823 Cunningham found what is known as "Pandora's Pass"—a good and practical stock route to the Liverpool Plains. Two years later, travelling through this pass, he examined the table-land to the north of Bathurst. In 1827 he made one of his most eventful trips, in the course of which he

[1] In the *History of Australian Exploration*, 1788-1888, to which I am indebted for many of my facts.

discovered the Darling Downs, and the Dumaresque, Gwydir, and Condamine Rivers. The next year he proceeded by sea to Moreton Bay, and connected the settlement with Darling Downs by way of Cunningham's Gap. His last expedition was in 1829, when he explored the source of the Brisbane River. Sir George Macleay was second in command on Captain Sturt's Morumbidgee expedition (1829-30), and contributed materially to discovery and other scientific work. Sir Thomas Livingstone Mitchell, Surveyor-General of New South Wales, was one of the most useful of Australian explorers. Between 1831 and 1832 he commanded an expedition, the object of which was to trace the mythical *Kindur*, but which led to the discovery of the Drummond Range. This journey of Mitchell's was important, because it revealed the courses of the rivers discovered by Oxley and Cunningham, by crossing them much lower down. Accompanied by Richard Cunningham (the brother of Allan Cunningham, and also a botanist, who, on this expedition, was murdered by the natives), Mitchell started again in 1833, and succeeded in identifying the Darling with the *Karaula* on the north and with Sturt's Murray junction on the south: the hypothesis of an interior river flowing to the north-west coast had to be finally relinquished. Mitchell's journey also helped to disperse the erroneous or exaggerated ideas as to the uninhabitable nature of the Far Interior. His remarkable journey through Australia Felix was undertaken in 1836; like the others, it was more of a connecting survey than a virgin exploration, but its results were of an important character: he obtained a full knowledge of the country and rivers south of the Murray and was able to confirm previously held convictions as to the value of the district. His last expedition (1845-6) was to the Barcoo. On this journey he discovered and named several rivers, and made known immense tracts of pastoral country in Central Queensland. Angus Macmillan, the discoverer of Gipps-Land (1840), which he named "Caledonia Australis," discovered several rivers which were afterwards re-christened by Count Strzelecki. Of all Australian explorers, probably the most distinguished was John M'Douall Stuart. His first expedition (1858) into the interior was to the west of Lakes Torrens and Gairdner. The next year (1859) he made another journey, at the commencement of which one of his party discovered the famous Hergott Springs; crossing Chambers' Creek, he discovered several other springs and the Neale Creek. His third expedition (1861) was in the vicinity of Lake Eyre. On this occasion, though his attempt to cross Australia from south to north was frustrated, he succeeded in reaching the centre of the continent. He discovered and named Central Mount Stuart, and christened the Murchison Range and Tennant's Creek, but failed in reaching the head-waters of the Victoria. Between the years 1861-2 he performed his last and most notable journey, from the terrible hardships of which he never recovered. Following his old track from Adelaide, and passing through the very heart of the continent, he reached the head of Arnheim Land, and was thus the first to cross Australia. His track is now marked by the enduring monument of the overland telegraph line. The expedition across the continent from Adelaide to

the Gulf of Carpentaria (1861) of JOHN M'KINLAY finally demolished the theory, which Stuart had so long and so successfully combated, that the whole interior of the continent was a terrible desert, quite useless for pastoral occupation. M'Kinlay's expedition to the East Alligator River (1864), with the object of finding a suitable site for a township, was not so successful. WILLIAM LANDSBOROUGH, who led the Queensland search party for Burke and Wills, explored (1861-2) the country from the mouth of the Albert River to the south of the Gulf of Carpentaria, discovering some rivers and several tributary creeks. He subsequently completed the overland journey to Melbourne: making for the Flinders, by way of the Leichardt, he followed up the river and discovered the beautiful downs through which it flowed; from thence he went to Bowen Downs, discovered by himself and Buchanan two years previously.

Between 1866 and 1867, the eminent Arctic explorer SIR GEORGE NARES surveyed the eastern and north-eastern shores of Australia and Torres Straits. SIR THOMAS MAKDOUGALL BRISBANE, Governor of New South Wales (1821), did much to encourage exploration and scientific research in others; the same may be said of his successor, GENERAL LACHLAN MACQUARIE, after whom the Macquarie River was called. CAPTAIN FRANCIS CADELL was the first (1850) to open up the navigation of the Murray River, upon which he placed steamers. MR. ROBERT LOGAN JACK, Government Geologist in Queensland, has explored and mapped considerable areas in that colony. The eminent botanist ROBERT BROWN made discoveries in Australia and other parts of the world which threw an entirely new light on the geographical distribution of plants. Baron Humboldt said that the name of Robert Brown would always be associated with "the minute development of the relations of organisation in natural families, the geography of plants and the estimate of their numerical proportions." His first great contribution to science was an account of the flora of New Holland and Van Diemen's land, which, with his succeeding works, initiated a new era in systematic botany.

The geographical nomenclature of Tasmania and New Zealand, like that of Australia, attests the presence of Scotsmen in the exploration of these countries, though I am unable, from the absence of data, to chronicle their work. MR. J. TURNBULL THOMSON, as Surveyor-General of New Zealand, carried out some pioneer explorations in the South Island. He explored and mapped 10,000 square miles of country, which was extended over unknown parts of the Lakes District by his subordinates, and he was the originator of what is familiarly known as the New Zealand system of survey, the aim of which is to rapidly establish settlers in occupation of their land, free from any subsequent risk from imperfect surveys or defective descriptions of title. The Provincial District of Otago grew out of a special settlement, originated in 1847, by a body of men adhering to the Free Church of Scotland, who purchased a block of 400,000 acres from the New Zealand Company.

Shortly after Cook's discovery of the islands of the South Sea, the London Missionary Society was formed, and their agents have ever since been in the van of exploration. Settling first at Tahiti, the missionaries

spread to the Hervey group, Samoa, the New Hebrides, and the Loyalty Islands, in the direction of New Caledonia, and then took up their, perhaps most successful, station in New Guinea. The exploration of New Guinea, which dates only some seventeen years back, is largely due to the missionaries of this Society, who have made the country accessible to Europeans. For this great service we are almost exclusively indebted to the missionaries W. G. Lawes, the "father of New Guinea travel," to JAMES CHALMERS, whose extensive explorations in south-eastern New Guinea exceed those of any other traveller, and to DR. M'FARLANE. Their contributions to geography, ethnography, and philology have been very considerable. MR. HENRY O. FORBES, whose recent ill-fated expedition to New Guinea was substantially supported by some members of the Royal Scottish Geographical Society, though unsuccessful in his main object of ascending the Owen Stanley Peak, surveyed and mapped a good deal of new country extending between the Owen Stanley range and Port Moresby. His original map and a report of his explorations were published in the fourth volume of the *Scottish Geographical Magazine*. Mr. Forbes had previously travelled in the Eastern Archipelago. Quite recently SIR W. M'GREGOR successfully explored the crest of the Owen Stanley Range, ascending Mount Owen Stanley, and naming several high peaks. The work of JOHN CRAWFURD is, for greater convenience, alluded to under "Asia."

MR. BURNS was the first European who ventured to explore the interior of Borneo proper. DR. GEORGE TURNER and his colleague, Dr. Nisbet, were the first settlers on Tanna, in the New Hebrides, from which they had to fly for their lives after seven months' residence. Dr. Turner's contributions to ethnology have been considerable. He made voyages through the New Hebrides in 1845, 1849, and 1859. He is remembered chiefly for his work on Samoa, to which I shall have occasion to refer. His son, DR. GEORGE A. TURNER, who travelled through the Ellice and Gilbert groups, etc., in 1874 and 1878, has written with acceptance on the islands of the Western Pacific.

BIBLIOGRAPHY: AUSTRALASIA, &c.

Accounts of SIR THOMAS MITCHELL'S extensive journeys, to which I have referred, were given by him in *Three Expeditions into New South Wales and Australia Felix* (1839), and *Expedition into Tropical Australia, Sydney to Carpentaria* (1848). In 1864 was published M'DOUALL STUART'S *Journals of Explorations in Australia, 1858-62*, which gives an account of his journey across the continent. DR. GEORGE TURNER'S *Samoa, a hundred years ago and long before* (1884) is a standard book of reference, and includes "Notes on the cults and customs of twenty-three other islands in the Pacific"; he also published *Nineteen Years in Polynesia* (1860). Dr. Turner's companion in Samoa, MR. A. W. MURRAY, the pioneer of the New Guinea Mission, who has travelled perhaps more extensively in the South Seas than any other pioneer missionary, served fifty-three years as an agent of the London Missionary Society. Of his numerous writings, I may mention *The Bible in the*

Pacific, which is an authentic record of the influences by which civilisation has been introduced in those regions, and its results, *Forty Years' Mission Work in Polynesiaand New Guinea* (1876), and *Missions in Western Polynesia* (1863). Dr. M'Farlane, in his *Story of the Lifu Mission* (1873), gives an account of the Loyalty Islands. Mr. Coutts Trotter, a leading authority and contributor on Polynesian geography, is the author of the paper in the R. G. S. *Proceedings* (vol. vi., 1884) giving a *Summary of our knowledge of New Guinea*, and of the article *New Guinea* in the *Encyclopædia Britannica*, neither of which have yet been superseded. James Chalmers, in *Work and Adventure in New Guinea* (1885), and *Pioneering in New Guinea* (1887), exposes his unique knowledge of the country and its people, and describes his extensive journeys. Foremost among the Scotsmen who have opened up the Western Pacific, especially the New Hebrides Group, is Dr. John Inglis, whose *Grammar and Dictionary of the Aneityumese Language* and book *In the New Hebrides* (1887), in which he deals with the geography, meteorology, and languages of that part of Melanesia, are one result of thirty-three years' conscientious and successful labour. Captain (afterwards Admiral) Erskine, who voyaged a great deal in those parts, published a remarkably well-written *Journal* of his cruises. Mr. H. O. Forbes' book on *A Naturalist's Wanderings in the Eastern Archipelago* (1885) is an original contribution of merit. The labours of John M'Gillivray, the naturalist, Mr. F. A. Campbell, the author of *A Year in the New Hebrides* (1873), Dr. Robert Hamilton, author of *Jubilee History of Victoria* (1888), Captain Palmer, whose journals of cruises in H.M.S. *Rosario* referred to the Labour Traffic, are also deserving of record. Mr. J. Turnbull Thomson, who contributed several scientific papers to the New Zealand Institute, wrote a book on *Life in the Far West*.

(*To be continued.*)

GEOGRAPHICAL NOTES.

EUROPE.

THE PARIS GEOGRAPHICAL INTERNATIONAL CONGRESS.

After an opening Address from the President, M. Ferdinand de Lesseps, the Congress, for the purpose of its deliberations, divided into seven sections:—(1) Mathematics, (2) Physics, (3) Economics, (4) History, (5) Education, (6) Voyages and Explorations, and (7) Ethnography and Anthropology.

The work of these seven sections may be thus briefly summed up:[1]—

(1.) In the first, the Mathematical, Section, presided over by Prince Albert of Monaco, a communication was made by Colonel Bassot on the methods of determining latitude. Colonel Derrécagaix explained the progress made in the method of drawing maps on a large scale; he insisted on the necessity of expressing altitudes in mètres and not in feet, and read a note on the Geographical Service of the French Army, of which he is the Director. A discussion, introduced by

[1] Translated from *Le Temps*, 9th Sept. 1889.

M. Triboulet, then ensued on surveys by balloon photography. Valuable information on this subject was furnished by MM. Triboulet, Blanchon, Bassot, and de Déchy.

M. Lallemand, a mining engineer, read a paper in which he demonstrated the necessity of correcting the results of extensive levelling in mountainous countries by taking into account the influence exercised by the variations of gravity. Passing to the examination of a uniform zero for the altitudes of Europe, he showed that, according to the most recent results of the new French surveys, the difference of level between the Mediterranean and the Ocean was not that of a mètre, as had hitherto been believed, but only of from one to two décimètres. Before choosing an imaginary base-level, it would be better to follow up the research for the mean heights of all countries. This proposition was favourably received by several of the most influential members of the Congress. M. Bouquet de la Grye contributed a note on the determination of the mean level of the Ocean.

Among other important communications were :—A critical account of the methods and instruments used during a century for determining the swing of the pendulum, by M. Defforges—methods that should be made uniform to facilitate a comparison of results ; and some remarks on various anomalies exhibited in Japan in carrying out observations of this sort. On the motion of M. Defforges, the Section adopted a Scheme of Observations to be applied in order to determine the variation of the force of gravity with altitude.

Prince Albert of Monaco submitted the results of his researches regarding surface currents of the North Atlantic. M. Caspari referred to the present state of our knowledge of Ocean currents, and M. Thoulet discussed the methods in use for the determination of temperatures, and of salinity and density of sea-water at various depths and in different regions. M. Guerreiro, with the object of laying stress on the results already acquired, and in order to encourage future observations, moved that the maritime States of Europe should agree to employ the same instruments for making experiments, and should follow the example of the United States in publishing periodically maps of the Ocean currents in the neighbourhood of their respective coasts.

(2.) The second, or Physical, Section discussed the erosive agents which tended to wear away mountain summits, destroy forests, bring about inundations, impoverish the soil, deteriorate the climate, and depopulate the country. Colonel Blanchot, after having taken up this question, proposed that the Forestry Department of the administration should forbid the partial disafforestation of mountains by private individuals. The Congress unanimously adopted the following Resolution :—"Considering the serious results of disafforestation, the Congress is of opinion that all nations which have the good fortune to possess forest-lands should protect the soil in every way, and that those nations which have suffered in this respect should take the most prompt and efficacious remedial measures."

M. Blanchot then explained a novel theory regarding the formation of Continents, which was criticised by M. Bleicher. M. von Schwerein, who had carried out explorations at the mouth of the Congo and on the West Coast of Africa, stated that in the whole of this region the sea was receding and the land was rising ; the rains were less and less frequent ; the earth was undergoing desiccation and contraction ; and hence, the continental land was increasing all along the coast.

(3.) The Economics Section, presided over by M. Meurand, had a paper from M. Darrasco on the Statistical Geography of the Argentine Republic, bearing

more especially on the causes of immigration and emigration; one from M. Charles Gauthiot on French emigration to Canada, which last year reached the number of 1000 individuals; and one from M. Turquan on the statistics of foreign immigration into France, and the emigration of the French to foreign countries.

The question was discussed: "What was the best method of colonisation?" MM. Carrasco, Peyret, Guillot, Gromier, Hennequin, Barbier, Blanchot and du Fief took part in the debate. The following Resolution was adopted: "The Congress, without entering into an examination of the political conditions that impose certain methods of colonisation on various States, pronounces in favour of the principle of Liberty."

The next two points on the programme had reference, one to the migrations in the interior of a State, the other to the natural laws that govern the origin, growth, and decline of towns.

Finally, questions were considered bearing on industrial and commercial museums, on the principal means of communication by land and water, and trade-routes. Colonel Blanchot moved the following Resolution, which was adopted after observations from MM. Carrasco, Hennequin, and Brettmeyer: "The Congress considers that the international maritime regulations, established formerly under conditions that have since been modified, are no longer suited to the present state of shipping. Those regulations should be revised as soon as possible in the interests of humanity, and for the protection of commercial interests; and the Congress earnestly hopes that the important work undertaken by the International Congress at Washington will be crowned with complete success in regard to its practical results."

(4.) The History Section, presided over by M. Barbié du Bocage, listened to a paper by M. Gaffarel on an anonymous Portulano of the first half of the eighteenth century. The Portulanos were outline maps drawn in the style of those used by the Venetians, Genoese, and Portuguese towards the end of the Middle Ages. These maps, which were intended to guide the navigator towards a given point, gave the name of, and indicated more or less precisely, the stations and towns which marked the various stages of the voyage.

A long memoir was read by Père Brucker on the maps drawn up by the Jesuits in China.

M. Castonnet des Fosses compared the commerce of Nantes with Spain, Flanders, and Bremen. This paper initiated a discussion between Père Brucker and MM. Gaffarel, Abbé Pisani, and Barbié du Bocage.

M. Drapeyron exhibited the first national atlas of France, dated 1592.

M. Rouire submitted his views concerning the rediscovery in the centre of Tunis of a hydrographic basin. He described this basin with its long artery taking its rise in the neighbourhood of Tebessa and emptying itself into the Gulf of Hammamet, the three lakes which it successively embraced at different stages of its course, the Sebkha Bagla, and Lake Kelbia, an important sheet of water in Northern Africa. Basing his remarks on the writings of ancient geographers and Greek and Roman historians, M. Rouire discovered in the river Triton and in the Sebkha Halk-el-Menzel, along the coast of the Hammamet, all the geographical individualities of Lake Triton—that is to say, the narrow channel by which the lake communicated with the sea, the island situated in the middle of the channel, and the long bank which connected the island with the continent.

M. Beauvois examined one of the controversial problems of historical geography, with regard to the travels of Zeno. He believes these travels really

took place, and attempted to prove them by means of the exact and detailed information recorded on the map of the explorer. M. Dahlgren, on the contrary, believed that the map was the result of a careful compilation at home of maps drawn long before.

M. Gaffarel criticised the division of France into Departments, and suggested certain modifications which seemed to him desirable.

M. Hentque examined the works of d'Anville with regard to the measures in use by ancient peoples. Abbate Pasha submitted at the same time a remarkable study of Mahmoud Bey on the value of the Egyptian *stadium*, published in the Transactions of the Geographical Society of Cairo. He dwelt on the little-known fact, that numerous traces of vine plantations have been found in Egypt; and there was reason to believe that this cultivation was abruptly interrupted by the incursion of the Mussulmans.

M. Coello attracted and retained the attention of his audience by a lecture which contained original and precise information on the Roman roads and highways in Spain.

(5.) The Educational Section was presided over by M. Vidal de la Blache. Two questions were discussed: (*a*) Whether the study of Ethnography should be introduced as a branch of higher education? and (*b*) Whether a special Professor of Geography should be included in the Faculties? The initiative of this discussion was taken by M. Ludovic Drapeyron, and the Section decided in the affirmative in regard to both of these questions.

Frère Alexis discussed the appliances for geographical instruction. He spoke of the choice of books, of cartographical exercises, wall-maps, geographical panoramas and reliefs. Several members of the Congress recommended the method in use in the primary schools, that is, the intuitive method, starting from the study of the commune, and expanding to that of the canton, etc. M. Dupuy objected to this system. The following Resolutions were adopted:—"(*a*) It is essential at first to combine the examples supplied by local geography in teaching the principles underlying general geography; then to give practical exercises on the data supplied by the maps of the Survey: (*b*) In the examinations the mere exercise of memory should be reduced, and it would be well to draw the attention of the Minister of Public Instruction to the advantage of publishing a memorandum to this effect: (*c*) The teaching of geography in special agricultural, industrial, and commercial schools should be based upon general geography."

(6.) The sixth Section took Voyages and Explorations under its charge. M. Masqueray, director of the École des Lettres at Algiers, communicated some interesting information regarding the Tuaregs which he had collected from conversation with the prisoners detained at Algiers. The exploration of the Paramanéma, an affluent of the Paraná, the Moluccas, the monuments of Samarkand, and especially the mausoleum of Tamerlane, the routes of communication in the Portuguese colonies (in the seventeenth century the Portuguese had already made their way to India by land), and the cannibal peoples of Brazil, supplied matter for interesting communications from MM. Cavalcanti, Timmerman, Han Poune, J. Leclercq, Sarva Prado and Grandidier.

(7.) The Ethnographical and Anthropological Section listened to the description of an exploration made by MM. Hamy and Delacroix in the south of Tunis, and to a communication by M. Ch. Rabot on the peoples in the north-east of Russia, Laplanders, and Finns. General Vénukoff presented an important work by General Grodekoff on the Kirghiz tribes, and Dr. Maurel read a paper on the origin of the peoples of Cambodia. M. de Gastine treated Ethnography

from the Fine Art point of view—that is, the classification, origin, and mixture of races—taking as the distinguishing characteristic the artistic manifestations of the human species. M. G. Vianna presented a study of the patois dialects of the Portuguese. M. Capus discoursed on the people of Kafiristan, their country, their costumes, the future of their country, the routes which led to it, and the interest which attached itself to the complete knowledge of that part of the Hindu-Kush. He finished his observations by remarks bearing on the distribution of the principal ethnic elements in Central Asia.

Notwithstanding this long programme of work, we have only given an incomplete sketch of the discussions and deliberations of the Congress. The Agenda were crowded—too crowded, perhaps—and under the cloak of Geography questions relating to alien subjects were frequently introduced.

ASIA.

Industrial and Commercial Progress in China.—Mr. R. S. Gundry read a paper on this subject to the British Association last month. Premising that the wide differences in character and habits of thought between ourselves and the Chinese made it difficult to convey to an English audience an accurate impression of the situation, the paper went on to sketch the leading features of Chinese industry and commerce in so far as they concerned, and had been affected by, foreign enterprise. Beginning to move at a time when she had been defeated in a foreign war, China's first efforts were to provide herself with the warlike material which experience had shown her to be so powerful. Hence the early construction of arsenals and steamers. The beginnings of telegraphs and the acceptance in principle of railways were due also, in a measure, to warlike stress in connection with Kulja and Tongking. And mining was recognised largely as a means of providing for all this additional expenditure. But imperfection of knowledge, jealousy of foreign supervision, and a disorganised condition of finance which involves venality and harassing taxation, retard a progressive movement, to which the *literati* who constitute the mind of the nation are still as a body disinclined. The imperial finances, too, have been strained by a series of wars, rebellions, and disasters; and distrust of their officials prevents native capitalists from investing money in enterprises with which the officials persist in meddling. The great staples of tea and silk are severely menaced by the competition of India and Ceylon in the one case, and of Southern Europe in the other; and the Chinese are slow to accept improved methods of preparation which would enable them to hold their own. China tea is heavily handicapped also by taxation, in competition with its duty-free rival. Fiscal hindrances, imperfect communications, and consequent cost of transport have much to do with the slow development of trade. But the wide prevalence of domestic industry, and difficulties of exchange caused by the demonetisation of silver, tend also to check the anticipated growth of demand for our manufactures. There seems every prospect that more railways will shortly be constructed, and that machinery will be tentatively admitted for purposes of industrial manufacture. But much time, a more widespread desire for progress, and radical financial reform will be required before China is likely to rival Japan in the completeness of its transformation.

Jade in Burma.—According to a recent official report from Burma, the jade-producing country is partly enclosed by the Chindwin and Uru rivers, and lies between the 25th and 26th parallels of latitude. Jade is also found in the Myadaung district, and the most celebrated of all jade deposits is reported to be

a large cliff overhanging the Chindwin, or a branch of that river, distant about eight or nine days' journey from the confluence of the Uru and Chindwin. Of this cliff, called by the Chinese traders "Nantelung," or "difficult of access," nothing is really known, as no traders have gone there for at least twenty years. Within the jade tract described above, small quantities of stone have been found at many places, and abandoned quarries are numerous. The largest quarries now worked are situated in the country of the Merip Kachins. The largest mine is about 50 yards long, 40 broad, and 20 deep. The season for jade operations begins in November and lasts till May. The most productive quarries are generally flooded, and the labour of quarrying is much increased thereby. In February and March, when the floor of the pit can be kept dry for a few hours by bailing, immense fires are lighted at the base of the stone. A careful watch is then kept in a tremendous heat to detect the first signs of splitting. When this occurs the Kachins attack the stone with pickaxes and hammers, or detach portions by hauling on levers inserted in the cracks. The heat is almost insupportable, the labour severe, and the mortality among the workers is high. The Kachins claim the exclusive right of working the quarries, and there is not much disposition on the part of others to interfere. Traders content themselves with buying the stone from the Kachins. The jade is then taken by Shan and Kachin coolies to Namia Kyaukseik, one long day's journey from Tomo. Thence it is carried by dug-outs down a small stream, which flows into the Tudaw River, about three miles below Sakaw, and down the Tudaw river itself to Mogaung. —*Academy*, August 17.

The Isle of Labuan.—In reply to Mr. Hunter in the House of Commons on the 22d August, Baron H. de Worms said :—"Owing to the insufficiency of the revenue of Labuan to maintain an efficient colonial administration, Her Majesty's Government have proposed that the chartered British North Borneo Company shall take over the administration of the island, which would remain a British colony, and would not be ceded to the Company. The terms and conditions of the proposed arrangement have not been settled."

The Nicobar Islanders.—Mr. Man, who has resided for seven years in the Nicobar group, contributes a comprehensive paper on this subject to the *Journal of the Anthropological Institute* (May 1889), from which we make the following abstract.

The Nicobar Archipelago, comprising twelve inhabited and seven uninhabited islands, form with the Andamans, Coco, and Preparis Islands, a series, as it were, of stepping-stones of volcanic origin, connecting the province of Burma with the large island of Sumatra. The following are the names of the islands: Car Nicobar, Chowra, Teressa, Bompoka, Camorta, Trinkut, Nancowry, Katchal, Pulo Milo, Little Nicobar, Condul, Great Nicobar, Batti Malv, Tillangchong, Meröe, Trak, Treis, Menchal, and Cabra; the last seven being uninhabited. The aggregate area of the group is about 635 sq. miles, or little more than one-fourth of that of the Andamans.

Kurz points out, in his *Sketch of the Vegetation of the Nicobar Islands*, that, geologically, they are divisible into two groups, the southern and the northern. The former, comprising Great and Little Nicobar, with the adjacent islets and Katchal, is characterised by the predominance of calcareous sandstones (brown-coal formation). The northern group includes Nancowry, Kamorta, Trinkut, Teressa, Tillangchong, Car Nicobar, and the smaller islands of Bompoka, Chowra, and Batti Malv. Alluvial deposits and plutonic rocks are the conspicuous features here. This geological division admirably coincides

with the general botanical appearance of the respective islands. While the islands of the southern group are forest-clad from the bottom to the top, the forests on the northern group are restricted to the plutonic rocks and to the slopes and dells of the older alluvium, while the hilly plateaux and ridges are covered with park-like grass heaths. Several of the Nicobar Islands, especially of the southern group, have hills ranging from 600 to 2000 feet in height. The physical aspect of the islands leaves nothing to be desired, and far surpasses that of the Andamans. The graceful and lofty arecas are not to be found in the Andamans, but are abundant in the Nicobars; and whereas the Andaman jungles present almost one continuous mass of nearly the same colouring, the Nicobar forests exhibit the most varied and luxuriant forms of vegetation. Tree-ferns, which are not found at the Andamans, grow in wild profusion along the river banks of Great Nicobar, where they frequently attain the height of 40 to 45 feet. The waters which lave these shores possess the extreme clearness and depth of colouring which is generally observable in the region of extensive coral reefs. There are several good harbours and many good anchorages at the Nicobars. In some of the larger islands there are navigable channels, and, at Great Nicobar, rivers which would prove of inestimable value in developing the internal resources of the country. Though teak and padouk are absent from the Nicobar forests, a variety of useful woods are found which promise a very profitable export trade in the future.

The chief drawback to residence in the Nicobars is the malarial fever which prevails more or less at all seasons. The variations of temperature throughout the year is less than at the Andamans; the maximum registered in the shade is between 93° and 94°, the minimum 73°, Fahr., and the average mean throughout the year 82° and 83°. The maximum reading of the barometer is 30·163, and the minimum 29·708; the mean range being about ·238. With regard to the rainfall, the register shows that the annual average amount corresponds with that at Port Blair, in the Andamans. It is greater in the northern group. The rains usually commence early in May, and rarely cease before the end of December. The duration of the SW. monsoon may be reckoned from the beginning of May till the middle of October, from which time the winds are variable till January, when they are usually from the NE. for about four months.

With regard to the numerical strength of the aboriginal population, from a census taken in 1884, it would seem that at Car Nicobar—which is the principal island of the group, and probably contains fully half the entire population—a decided increase is taking place; a like result is to be observed at Chowra, Teressa, and Bompoka, but a diminution in the number of inhabitants seems to be observable in the central and southern portions of the group. In 1886 Mr. Man estimated the number of inhabitants in Car Nicobar at 3500. He says that the establishment of our colony has completely attained its primary objects, and has also been the means of attracting a regular and growing trade, and of enlightening the natives a little as to the benefits and resources of civilisation.

Mr. Man discusses his subject chiefly from the anthropological point of view; we do not, therefore, require to follow him much further. He says that: "In studying the aborigines of the Andamans and those of the Nicobar Archipelago, the most casual observer could hardly fail to be struck with the wide distinctions which exist, not only in their language and physical characteristics, but also in their culture and customs. While the Andamanese, in spite of their many excellent qualities, must be regarded as one of the most degraded and barbarous

races in existence, the Nicobarese, especially of the northern islands, prove themselves worthy to be ranked almost on terms of equality with their kinsmen inhabiting the Malayan Peninsula, and evidence is not wanting to show that they are capable of acquiring and *surviving* a higher degree of civilisation than that which they have as yet attained. The Shom Pen[1] have been—and I believe with good reason—accepted as the pristine indigenes, and their remote origin and purity of breed is apparently beyond question, while the various sections of the coast tribe, although differing from each other according to external influences and other circumstances, are without doubt descended from a mongrel Malay stock, the crosses being probably in the majority of cases with Burmese, and occasionally with natives of the opposite coast of Siam, and perchance also in remote times with such of the Shom Pen as may have settled in their midst; the fact that the Shom Pen present Mongolian affinities would thus to some extent account for the frequent occurrence of the oblique eye in a more or less marked degree throughout the group." Mr. Man's paper is accompanied by some excellent photographs of natives.

AUSTRALASIA.

Exploration in Central Australia.—The Melbourne *Daily Telegraph* of 12th August 1889 publishes the following :—

Mr. A. C. Macdonald, Secretary to the Victorian Branch of the Australasian Geographical Society, has forwarded to us for publication the following telegram, from Mr. W. H. Tietkins, the leader of the Central Australian Exploring and Prospecting Association, from Charlotte Waters in South Australia :—

"*August* 10, 1889.

"To Hon. Sec. Royal Geographical Society, Melbourne.

"The expedition of the Central Australian Exploring and Prospecting Association, under my command, arrived at Erldunda on 22d July. Party all well. The principal incidents and features of the journey I have the honour to lay before you. The expedition left Glen Edith 10th May. While there, experienced four days and five nights of almost incessant rain ; forty miles west of Glen Edith discovered and named the Cleland Hills and Gill's Creek, flowing south, and twelve miles of running water ; extent of good country limited. In east long. 129° 15′, south lat. 23° 32′ 49′, discovered and named the Beetson's Hills, and three miles of running water ; extent of available country limited. In east long. 128° 45′, south lat. 23° 20′, discovered and named the Kintore Range, the highest peaks, Mount Leisler and Mount Strickland, 1500 feet above the plains. Here we experienced three days' heavy rains. In south lat. 23° 22′, east long. 128° 15′, discovered and named Lake Macdonald, after the hon. secretary of Victorian Branch. It extends westerly to east long. 127° 50′, its south shore being in lat. 23° 40′. A little good saltbush and grass country, with clay-pans round the lake south of the Kintore Range. Visited and named the Davenport Hills in lat. 23° 40′. From there travelled south-easterly through the extent of the probable outline of Lake Amadeus to Blood's Range ; the highest peaks, named Mount Harris and Mount Carruthers, being 1400 feet above the plains. Mount Unapproachable (?) marks the west extremity of Lake Amadeus, its south shore north of Mount Olga being in lat. 24° 39′ 16′. I regret to say that at Lake Amadeus two camels partook of a poison plant, from the effects of which one died at Mount Olga ; the other, unable to travel after a week's rest, was left there. Visited Ayer's Rock. Mr. Gosse's marked tree has been burned

[1] The Shom Pen are the inland hill tribe.—Ed.

down by the blacks near Mount Connor. Discovered a small spring travelling northward. From there discovered and named the Basedow Range. From there travelled easterly over better country until I arrived here, receiving a most cordial and hospitable reception from Messrs. Warburton and Tomlin. To Mr. Warburton's kindness we are indebted for conveying this message to the telegraph line. The general character of the country passed over has been spinifex, sand-hills, and plains, with extensive forests of *Casuarina*. No blacks were seen, though they were frequently about the rock reservoirs. Native wells and a few clay-pans were the only descriptions of water met with.

"W. H. Tietkins."

The above letter is dated from Erldunda, 25th July 1889. Erldunda, situated 150 miles north-west of Charlotte Waters Telegraph Station, is an outlying cattle station which, two years ago, was brought into public notice by an attack made upon it by a party of blacks, two of whom were afterwards captured and sentenced to short terms of imprisonment at Port Augusta.

New Guinea: Exploration of the Owen Stanley Range.—Mr. J. P. Thomson, our Hon. Corresponding Member at Brisbane, writes to us, 15th July 1889, as follows:—"After an absence of about two months, Sir W. McGregor, Administrator of British New Guinea, has returned to Port Moresby, having successfully ascended Mount Owen Stanley, and explored the neighbouring country. Sir William, with a party of fourteen, left Port Moresby in an open boat on April 19th (1889), and entered the Vanapa River about 30 miles to the westward; a period of eight days was occupied in ascending this river, during which time many obstacles presented themselves, especially numerous rapids and rocks; at the end of the eighth day he camped on the left bank of the river till reinforcements arrived from Port Moresby. On May 17th the party, comprising forty-two men, including four whites, all, including Sir William, carrying baggage, started to cross the high lands of the interior; he crossed and named Mount Gubar at an altitude of 1700 ft. A camp was formed at Goodwin's Village, Mount Musgrave, so named by Sir William, and after the party had been reduced to four Polynesians and seven natives, the mountain was crossed at an altitude of over 7000 ft. On the 9th June he commenced the ascent of Mount Owen Stanley, and on the 11th reached its summit. The formation of the country consisted of decomposed slate, quartz, and granite, without any indications of gold. In the lower altitudes, and up to an elevation of 8000 ft., the atmosphere was moist, but a dry and bracing stratum existed at all places above that. The natives found in the higher altitudes, who are stout, well built, with short legs, were, notwithstanding their superstitious natures, extremely friendly; they possessed no war implements, but wore elaborate head-dresses adorned with shells. These shells, which were procured from the east coast of German New Guinea, combined with the detailed knowledge they possess of villages *en route*, were sufficient to show that practicable routes of communication exist across the Owen Stanley Range. Their plantations, which were well cultivated and enclosed by fences, contained yams, sweet potatoes, sugar-cane, and tobacco in great profusion. Although extremely friendly, their women were not seen. Sir William collected some lovely yellow rhododendrons, and a variety of new plants; new grasses were also discovered in large patches on Mount Victoria. A new animal, somewhat resembling the Australian native bear, excepting in its possession of a tail, was secured; this animal, the extreme length of which is 3 ft. 6 in., with a bushy tail 1 ft. 6 in. in length, has five claws on the front feet, and four claws on the hind feet; its colour is a dusky brown to black in the extremities, and its

estimated weight about 40 lbs. Excepting a new bird of paradise resembling the *Epimachus*, the birds met with in the lower altitudes were those common to known parts. In the higher altitudes a female *Astrachia Stephania* was procured; at Mount Victoria several new small birds were found, some of which are identical with the English lark. Our knowledge of the entomology of the region is increased by a few new specimens, including some milk-white butterflies.

The highest crest of the Owen Stanley Range, which Sir W. McGregor named Mount Victoria, is 1¼ miles long, and 13,121 feet above sea-level; it is composed of about six great masses of rocks, each being quite flat on the top and measuring about 66 feet wide; these separate serratures, which were so decomposed on top as to be easily punctured with a stick, were ascended by Sir William and examined.

The Owen Stanley Range is not constituted of numerous disintegrated serratures composed of inactive volcanic cones as has been previously described; it is, broadly defined, a continuous unbroken mountain range, 30 miles long, extending from Mount Victoria in the south-east to Mount Lilley in the NNW., its lowest point being Dickson Pass, 10,884 feet. The mean altitude of the four peaks on Mount Victoria is 13,076 feet, and the mean corrected barometer reading 19,080. The source of the Vanapa River, through which the southern slopes of the Owen Stanley Range are exclusively drained, is situated between Mount Griffith and Mount Knutsford, at an elevation of 11,000 feet above sea-level. The first place reached on the top of the range was named Winter Height, its altitude being 11,882 feet, the next eminence, which was named Mount Douglas, is 11,796 feet. In addition to those described, the following mountains, separate from the Owen Stanley Range, were named by Sir William, viz.:—Mount Knutsford, 11,157 feet; north of Owen Stanley Range, Mount Albert Edward, 12,500 feet; Mount Scratchley, 12,000 feet; Mount Gillies, 8000 feet; Mount Parkes, 8000 feet; between range and Brown River, Mount Service, Mount M'Ilwraith, Mount Morehead, 10,000 feet to 11,000. Numerous icicles were seen on the top of Mount Victoria, and its surface was covered at night with white frost; the sky both day and night was perfectly cloudless. This favourable condition enabled extensive observations to be made of the surrounding country, also of the northern coast of the German possession, a large section of which was plainly visible. The natives hunt on the top of Mount Musgrave, and on Mount Knutsford at an elevation of over 9700 feet. Daisies, buttercups, forget-me-nots, and heaths were found on Mount Victoria, and strawberries on Mount Douglas. The natives were friendly, and neither those met with on the outward journey nor those forming the expedition showed the slightest indications of fear or superstitious dread for the uninhabited heights of the Owen Stanley Range. No timber exists within 1000 feet of the crest of Mount Victoria."

In a telegram to the Governor of Queensland, a copy of which was courteously supplied to us by the Colonial Office, Sir William McGregor gives in telegraphic form the information with which Mr. Thomson supplies us in the above communication. We draw attention to the fact that, at the recent meeting of the British Association at Newcastle-upon-Tyne, Mr. Coutts Trotter mentioned that some of the peaks already named by Mr. Henry O. Forbes had been re-named by Sir William McGregor.

ARCTIC REGIONS.

Spitzbergen.—Dr. Kükenthal and Dr. Walter, who in the Spring of this year on behalf of the Bremen Geographical Society set out for Spitzbergen to

carry out zoological explorations in the Arctic Ocean, have sent fresh information home. They left Tromsö on 7th May for their destination. Bear Island was sighted on the 13th. Firm ice was met with in 75° N. and 23° E., stretching SE. and NW. Storms, bad ice-conditions, and shipwreck interrupted the expedition, but from a letter to the Bremen Geographical Society, dated from the SE. coast of Stans Foreland (Spitzbergen group), 17th August 1889, some good work seems to have been accomplished. The information in regard to the little-known King Charles Islands,[1] to the east of Spitzbergen, is valuable.

On the 12th July they sailed north to the Foster Islands, and reached latitude 79° 31′. In the neighbourhood of Amsterdam Island obstructions prevented a complete circumnavigation of Spitzbergen. They dredged in the unexplored Olga Straits, in which over 100 observations of depth were made. The greatest depth (266 mètres) was found to the south of King Charles Islands, about 6 miles distant from East Cape. The coast contours were mapped as far as possible, and sketches of the country were made. One important result was the discovery of a strong current of water flowing through the Olga Straits from north to south, and, near the King Charles Islands, being diverted to the SE.; this current was extremely strong from the middle of July to the middle of August. At the end of June the surface temperature (mean) of this current of water was + 1°·5 C.; from July to the middle of August the temperature rose to 2°·6 C. The temperature of the water showed a rapid diminution as greater depths were reached: for instance, in the middle of the Olga Straits, on 26th July, the surface waters registered a temperature of + 3°·2 C., but at a depth of 22 fathoms the water was only + 0°·3 C.

On 30th July the travellers were on the Ryk Ice Islands. They found only three small islands, which could not be recognised by the three large islands of about 3 miles in length represented on the map; the latter were nowhere seen, nor do they exist. Vegetation was extremely poor; not a single flowering plant was found. Traces of reindeer were found, indicating that long journeys are made by them on the firm ice. The journey along the east coast of Stans Foreland, which was free from ice, resulted in good geographical work being accomplished. The immense King John Glacier, which forms the greater part of the SE. coast, does not end at Stans Foreland, but extends further N. and NW., ending abruptly in a turn to the W. and WSW.: thus forming a bay, of about the size of Deevie Bay, which is called by the whalers the Blue Fjord, from the distant blue mountains to be seen in the interior. Nearer examination, however, disproved the existence of a fjord at all.

As regards air temperatures, taken on the west of Spitzbergen and in the Olga Straits, the following are given :—

	Mean Temperature.	Maximum.	Minimum.
June 20-30 . .	1°·5 C.	(27th June, 8 P.M.) + 4° C.	(25th June, 8 P.M.) − 1°·2 C.
July	2°·1 C.	(23d July, 12 noon) + 5° C.	(18th July, 4 A.M.) − 0°·7 C.
August 1-15 . .	2°·8 C.	(6th Aug., 12 noon) + 4°·3 C.	(4th Aug., 4 A.M.) + 1° C.

These are commented on as very low temperatures for an Arctic summer. Drs.

[1] Called by the whalers "Gillis-land." A Note on this subject will be published next month.—ED.

Kükenthal and Walter sailed for Tromsö on 24th August, where they arrived on 6th September. They propose returning to Bremen this month.

ROUTES, RAILWAYS, CANALS, ETC.

Proposed New Ship-canal.—A scheme for constructing a ship-canal between Birmingham and the Mersey is being actively pushed forward, the survey having been just completed, and the estimates prepared. An entirely new canal will be constructed from Birmingham through the principal iron and coal centres of Staffordshire and the Potteries, and uniting with the Weaver Navigation at Winsford, finally communicating with the Manchester Ship Canal and Mersey. The change of levels will be overcome by hydraulic lifts similar to those in use on the Senne in Belgium. It has been decided to increase the proposed width of the canal from 60 feet to 72 feet, rendering it equal to navigation by vessels of 500 tons burthen as compared with 300, as originally proposed. As now estimated, the capital outlay will be nearly three millions sterling, a quarter of a million being required for the hydraulic lifts. Instead of the traffic of two millions of tons per annum, however, the promoters believe it will approach ten millions. A bill empowering the construction of the canal will shortly be promoted in Parliament.

Decline of Constantinople as a Trade-Centre.—The British Consul-General at Constantinople in his last report refers to the declining commercial importance of that city. Its trade has suffered considerably since 1878, and more particularly during the past two years. Large wholesale houses which formerly did business with Persia and Central Asia, and acted as middlemen between European manufacturers and the merchants of those parts, have in recent years lost their customers, and are gradually disappearing from the city. This is owing, in a measure, to new and more direct routes having been thrown open to markets that were formerly supplied from Constantinople, and also to the fact that produce which used to go to the Turkish capital for shipment to Europe is now despatched direct from the out-ports. Persia, which previously drew a considerable part of her imports from Constantinople, has latterly commenced to make use of Bushire, and the entire import trade of Lower Persia is at present centred in that place. The provinces of Azerbijan and Mazanderan alone continue to take their supplies by way of Constantinople, and then only when Russian competition permits of their doing so. The export trade of the city has suffered in a similar way; the produce of Turkish Kurdistan, estimated to amount to an annual value of £320,000, which two years ago went through the capital is now shipped from Bagdad—a route which is considered to be less expensive and safer. As regards Persian trade especially, Mr. Fawcett observes that during the years 1887-88 it was not satisfactory. Dealers in Manchester goods suffered considerably, owing partly to Russian competition, and also to the high rate of exchange prevailing at Odessa, which affected Persian markets and caused severe loss to merchants having remittances to make abroad. During the year 1887, according to official statistics, Trebizond received in transit 20,620 bales, as against 27,856 bales in 1888. This increase in the import in favour of last year is attributed to the rise in value of the paper rouble, which debarred Persian merchants from doing business with Russia. In February 1888, exchange upon London at Odessa had reached 12r. 50c. At the end of the year the quotations were only 9r. 40c. The difficulties which arose in the course of last year with the Ottoman Custom-house authorities in regard to the transit trade with Russia have been satisfactorily settled.—*Scotsman*, August 21, 1889.

The Great Central Asian Trade Route from Pekin to Kulja and Semirechensk, and to Yarkand and India.—Colonel Mark S. Bell, V.C., read a paper on this subject to the recent meeting of the British Association, of which the following is an abstract :—Kashgaria is reached from Pekin by the Ala-shan, or generally speaking, desert camel-route, *viâ* Kwei-wha-cheng and Barkul, and the Wei Valley route, a cart road leading through Pau-ting-fu, capital of Chili ; Tai-yuen-fu, capital of Shansi ; Si-nan-fu, capital of Shensi ; Lan-chow-fu, that of Kansuh and Hami, crossing the Gobi desert between An-si-chow and this latter place. The route would be classified by the Chinese into stages as below, and would be each assumed to take eighteen days of travel—*i.e.* Pekin to Tai-yuen-fu, 375 miles ; Tai-yuen-fu to Si-nan-fu, 438 miles ; Si-nan-fu to Lan-chow-fu, 449 miles ; Lan-chow-fu to Su-chow, 482 miles ; Su-chow to Hami, 418 miles ; and thence onwards, Hami to Hung-miot-za, 408 miles ; Hung-miot-za to Ili, 400 miles ; Hami to Karashahar, 420 miles ; Hung-miot-za to Karashahar, 256 miles ; Karashahar to Aksu, 373 miles ; Aksu to Kashgar, 311 miles. Few Europeans have traversed this route since the days when the conquests of Ghenghis Khan and his successors opened Asia to the inspection of Christendom, and none have done so in its entirety since the Mohammedan rebellion in the north-west of China before 1887, when Colonel Mark Bell did so. After describing the route through Shansi to Si-nan-fu and touching upon lateral communications and the mineral and agricultural resources of the districts traversed, the commercial importance of the Wei Valley is dwelt upon, and it is shown how this centre of gravity and of resistance of Mid-China is cut off from the rest of the empire by mountainous or hilly regions at present most difficult to traverse. The routes possible to be followed by railways are reviewed, and the necessity of this rapid communication to China, if she desire to retain possession of her north-west provinces and Kashgaria, is pointed out. From Si-nan-fu the route turns to the north-west and leaves the fertile loëss valley of the Wei to traverse the once fertile but now devastated and depopulated hills and valleys of Shensi and Kansuh to the confines of the Gobi desert at An-si-chow. The description of this route, which crosses passes elevated 10,000 feet, is followed by that of the Gobi route to Hami. In conjunction with them are considered the lateral communications, resources of the district in coal, etc., and the inhabitants, both of this wedge of cultivation held by the Chinese in the past as a means of gaining access into Central Asia, and of its lateral mountains and deserts. The importance of this bottle-shaped portion of Kansuh, the one and only natural route between the extreme east and the extreme west, as a means of communication between Central Asia and Mid-China, is pointed out, and its fitness for a railway route and its influence over such as our Chinese trade, discussed. From Hami the route over the Tian-shan to Barkul and through this range and along its northern *glacis* slopes to Hung-miot-za is described, as well as the falling away of this great range here, and the natural access that at this point exists between the Tian-shan-peh-lu and the Tian-shan-nan-lu, *i.e.* the two great historical routes from Hami to the north and south of the Tian-shan range. This section of the Central Asian trade route and of the Tian-shan range with its arid deserts and paradises of oases has not been previously described in detail.

An account of the Tian-shan-peh-lu and Nan-lu is followed by a few remarks on the routes into Russian Turkistan and Ladakh from Kashgar and Yarkand. As China is of interest to Great Britain as a possible military ally in the future, and as a present certain and important commercial one, the study of the political geography of the country traversed by this most important cart

route of the past and coming railway one in the future, is a very necessary one to our Eastern interests, requisite to enable us to foresee coming events and to mould them to our advantage. As an incentive to this study the paper on this route has been prepared. A short summary of the various sections of the route, as traversed, is here given :—

From Pekin the route runs over the great plain of Chili for seven days (218 miles) to Whailu, and thence for five days over the hills separating Chili from Shansi, about 130 miles broad, and passing over heights of 4500 feet to Tai-yuen-fu. This belt of hills, of loëss, extends from the Nan-kow Pass on the Pekin-Kalgan road in a south-west direction to the Yellow River, and is crossed by carts only at this crossing-point, and on the Tung-kwan, Honan-route, *i.e.* the Yellow River route. The hills are cut up into numberless ravines, and in them it is difficult to move anywhere off a few tracks. Shansi, now traversed, is rich in coal and iron, but does not grow enough grain for its own consumption. Between Tai-yuen-fu and Si-nan-fu valley, the roads are similar to those over the loëss hills, and a difficult range, at the Han-sin-ling pass elevated 4000 feet, is crossed between the Tai-yuen-fu and Ping-yang-fu basins. The roads are but deep gullies, 8 feet to 10 feet wide and 30 feet to 50 feet deep, for miles. They are practically suited for one line of traffic only ; there is not a metalled road in the country. Shensi produces abundance of grain. For days around Si-nan-fu the traveller passes through one vast wheat-field. From Si-nan-fu, capital of Shensi, to Lan-chow-fu, capital of Kansuh, 450 miles, the road passes over a difficult, hilly country, over heights of 8000 and 10,000 feet, and is during the greater part of the time at an elevation of 6000 to 7000 feet. The road is at times a fine highway, at others a deep gully ; its inclines are steep ; the greater part of the country is depopulated and its villages destroyed ; a few of the walled towns have alone escaped the Mohammedan rebellion. No confidence has returned to the people, for it is fourteen years since the rebellion ceased, and the land is still untilled ; the Mohammedans, braver than the "Heathen Chinee," are feared by them. These considerations give some idea of the present weak connection that exists between China and Kansuh. Between Lan-chow-fu and Su-chow, 482 miles, the road twice passes over heights of 8000 to 9000 feet by easy and gradual ascents and descents. For a part of this distance only it passes through a narrow strip of cultivation ; for the rest it runs over a barren plain or amongst low hills. An easy road through a very devastated country leads to An-si-chow, bordered by the Nan-shan Mountains and the desert occupied by the Tibetans and Mongols ; the Chinese occupy the narrow intervening strip, which consists of cultivated stretches, desert, and grazing grounds.

The Gobi for 200 miles is almost an absolute desert ; water can, however, be readily obtained and is often close to the surface, and springs occur apparently at intervals of 20 to 30 miles in any direction. The route could be readily stocked with grass from Hami, but carters prefer to carry chopped straw and grain. The water is brackish but wholesome. At Hami, a rich oasis of no size, the two cart ruts from Si-nan-fu open out into four, two going to Kulja, 800 miles, and two to Kashgar, 1200 miles. Here also a good camel-road joins in from Pekin, it passes through desert chiefly to Kwei-hwa-cheng, and supplies have to be carried.

Barkul, the Chinese Pa-li-kul, is reached from Hami in three days over a pasture country beyond the pass over the Tian-shan, elevated 9000 feet ; thence for 130 to 140 miles the Tian-shan is traversed by an easy cart-track, leading through natural valleys, with good pasture here and there, but otherwise all

desert. On leaving the hills, to Hung-miot-za or Urumtsi, 200 miles, a few towns are met with, and at intervals desert, pasture, and fertile oases alternate. The oases are occupied in part only; the towns and villages are in ruins, and rank grasses choke many of the fields.

Hung-miot-za is now the capital of Kashgaria, or the Sin-kiang or New Province, formed to include Kashgaria, Outer Kansuh, Ili, Zungaria, etc., and extending to the Russian border and Mongolia. Here the Chinese have concentrated their chief military strength, and are building a new city. Hence the cart road leads on to Ili, 400 miles. From Urumtsi the Tian-shan range was re-crossed to Toksun, a remarkable depression in Central Asia, elevated about 350 feet, by an easy pass; country, generally desert; from Toksun a hilly country is passed through, heavy for carts; road over sand and shingle, chiefly desert for 140 to 150 miles before the oasis of Karashahar is reached, the natural eastern limit of Kashgaria; to its west lies the difficult pass leading to Khur or Khorlia, 33 miles off, whence it is 340 to 350 miles to Aksu, the country between consisting of much desert, a little pasture land, with oases at intervals. A China boy from Chifu at Karashahar delivered himself of the opinion that *Sin-kiang no belong first chop piecie place;* it improves westwards, for several of the oases, Khur, Kuchar, Bai, etc., are of size, and in them grain is plentifully grown, and fruits and milk in all its varieties abound. Aksu is an important trade centre, but a most filthy town, and here Indian merchants are first met with.

From Aksu to Kashgar the country consists of forests, deserts, and oases, some of the latter of size. Mosquitoes were in myriads between Toksun and Karashahar, and nearly killed the horses, and here the stretches of forest, some 30 to 50 miles deep, must be rushed at night, for from dawn till dusk horse-flies occupy them in millions.

At Kashgar the Russian consul makes a good show with an escort of fifty Cossacks, and his presence there is looked upon as the first step towards the annexation of Kashgaria by Russia; the Turks do not favour the Russians, but would not fight for the Chinese. They are a gone-by people, and can never hope for independence; their possible future dependent position on Russia may, however, be an eventful one.

A fertile country connects Kashgar and Yarkand, and from the latter town, the chief centre of Indian trade, caravans reach Leh in a month; horses have to be trained for this hill route, which is well frequented notwithstanding its difficulties and the loss of ponies that takes place; both are remediable, and should be remedied, for to pack-animals it is a veritable passage through the vale of the Shadow of Death in its present state.

MISCELLANEOUS.

Globus (No. 7, 1889) states that the Government of **Queensland** has commissioned Mr. A. Weston, accompanied by Messrs. Broadbent and Bailey, to explore the northern portions of the colony.

Globus (No. 7, 1889) states that the interior **Commerce of Germany** for the year 1888 amounted to 6788·5 million marks, so that Germany now ranks as the chief European commercial power after Great Britain, and before France. The exports of Germany amounted in 1888 to 3352·6, and the imports to 3435·9, million marks.

Her Majesty's Treasury last July entered into a contract with the **Canadian Pacific Railway** for a monthly service of mail steamers to Yokohama, Shanghai,

and Hongkong. The yearly subsidy is to be £60,000, of which the Dominion Government have agreed to pay £15,000. The average period of transit stipulated for between Halifax and Hongkong is 29½ days.

M. Trivier, the French explorer, arrived on February 18th at Stanley Falls. His aim, says the *Athenæum* for 17th August, is the exploration of the **Lukuga**, from its confluence with the Congo to where it issues from the lake. Having accomplished this, with the willing aid of Tippu Tib, M. Trivier proposes to proceed to Zanzibar, where he hopes to arrive in November.

At the meeting last month of the British Association, Mr. E. G. Ravenstein read a paper on Geographical Co-ordinates in the valley of the **Upper Nile**. He discussed more especially the observations for longitude which had been taken by Major Watson, Colonel Mason, Colonel Prout, Captain Speke, and Lieutenant Baker, and pointed out that they formed a continuous chain extending from Khartûm to the Albert Nyanza, no link of which should be removed, as had been done in the maps of Dr. Junker's travels recently published at Gotha.

L'Afrique for August, 1889, states that the delegates of Great Britain, Portugal, the Transvaal, and Swaziland, have determined on the frontier line between Lorenzo-Marquiz (Delagoa Bay) and **Swaziland**. The frontier line starts from the river Usuto in the south, traverses the Lobombo mountains by their water-parting and, inclining to the NNE., terminates at the point where the frontier of the Transvaal and the territory of Swaziland meet the Portuguese frontier. Sir Francis de Winton leaves shortly for Swaziland on a political mission.

Colonel Mark Bell, in the recent numbers of *Blackwood's Magazine* (April—July, 1889), and at the meeting of the British Association at Newcastle, has given accounts of his extensive explorations in **Central Asia**. His remarks in *Blackwood* regarding the Karun River territory are, in view of its opening up to commerce, of special interest just now. On 26th March 1884 he left Mohammera for Dizful, *viâ* Ahwáz and Shuster; there he left the Karun in order to reach Kum by way of Khoramabad and Sultanabad, arriving there on the 25th April. The return journey was *viâ* Feridan and Ispahán to Bushire.

Mr. W. M. Flinders Petrie, in a paper to the British Association on **Wind-action in Egypt**, pointed out that the underlying motions of the Delta are depression on the coast, and upheaval at Ismailiyeh. Above these movements great changes have been made by wind-action; in some sites at least 8 feet of ground have been removed, and deposited in the water. This has partly caused the great retreat of the Red Sea head, and tends to form the characteristic swamps of this district. Formerly the Delta was a desert track, with valleys inundated by the Nile. Before historic times the Nile valley was deep in water, partly estuarine, partly fluvial, and great rainfall then took place. That this was in the human age is shown by the position of worked flints.

Lieut. L. von Hohnel, in the *Mitteilungen* of the Vienna Geographical Society, fully accepts the view that the **Omo** or Gibbe finds its way into the large lake recently discovered by Count Teleki, and suggests in addition that the Baro, which is usually supposed to flow northwards toward the Sobat, flows to the south and terminates in the same lake. It would be idle to speculate on this latter question until the whole of the information recently collected by Borelli and others shall have been placed before us. In the same periodical will be found an interesting paper on recent measurements of heights in Southern **Tyrol** and the Venetian **Alps**. Dr. Diener remarks that the results affect very materially our present notions of the hypsography of these Alps.

The *Mitteilungen* also publishes the remaining sheet of a huge map of the Congo, based upon surveys by Dr. O. Baumann, and all other available materials. This is, no doubt, the most satisfactory map of the Congo between Stanley Pool and Stanley Falls that has been published hitherto.—*Athenæum*, 17th August, 1889.

NEW BOOKS.

Hand-Book of Commercial Geography. By George G. Chisholm, M.A., B.Sc. London: Longmans, Green and Co., 1889. Pp. 515. *Price* 16*s*.

Mr. Chisholm's book is designed, as stated by him in his preface, "to impart an intellectual interest to the study of the geographical facts relating to commerce." Three classes are intended to benefit by the book—teachers who wish to enliven their geography lessons by introducing references to commerce, commercial pupils of the higher schools and colleges, and intelligent young men entering on commercial life. The aim and the expected students have been clearly kept in view throughout the work, which shows a vast amount of thoughtful and discriminate compilation, and gives prominence, as is fitting, to the clearest relations of cause and effect, passing by numerous problems the solution of which is yet far from us.

Mr. Chisholm acknowledges the sources of his information in the preface, specially mentioning this *Magazine*, and paying a well-deserved tribute to the profound and practical geographical knowledge of the leading British mercantile men, picked up through business and not by books. The plan of the work is the familiar one of first treating some "General facts relating to the production, distribution, and exchange of commodities"; next commodities themselves, classed as "I. Commodities dependent directly or indirectly on climate; II. Products of Fisheries; III. Mineral Products; IV. Manufactured Articles in which various materials are used." Then follow 230 pages dealing with "Countries," and an appendix of 50 pages containing a number of valuable tables of trade, wages, prices, distances, measures, etc.

The first part, dealing with general conditions and commodities, seems confusedly arranged; the divisions are not mutually exclusive, and the composition is in many cases a cumbrous adaptation of long German sentences. The thorough acquaintance of Mr. Chisholm with Economics, and his knowledge of physical science, enable him to present a number of striking explanations of the commercial position of nations and the changes of trade; but many consecutive pages would be more in place in a treatise on the economics of industry than in one on commercial geography. This does not detract from the value of the book to the practical man, to whom it matters nothing under what name he obtains trustworthy and suggestive information; but it is a drawback to the scientific geographer, who is at a loss as to what department or aspect of his science should be ranged under the title of Commercial Geography. Mr. Chisholm offers no definition to help us out of this difficulty.

One or two controversial subjects are treated in a dogmatic manner. The spelling of the English language is held up as a serious drawback to commerce! To our mind the difficulties of English spelling are highly educational, requiring persevering effort to learn, teaching mistrust of sweeping rules and the importance of being always on the alert for exceptions. This is precisely the

spirit required in searching for scientific facts, or establishing education on a scientific basis, but the discussion is not geographical. Mr. Chisholm evidently sympathises with the prevailing tendency to slur over exceptions and difficulties, and reduce everything to a few simple rules ; and he uses the system with great effect to impress the broad relations of climate and crops, for example, thereby giving confidence to his reader ; and we must admit that he rarely exceeds the safe limits of this method.

The treatment of countries, which is largely on the lines of the author's school geographies, in all cases shows acquaintance with the latest official information. The seaports of each nation are admirably described, the growing superiority of artificial to natural harbours being insisted on. Perhaps too much prominence is given to internal water-communication ; the canals of France, for example, receive nearly a page of description, while the railways are only referred to incidentally. In other countries full justice is done to the railway systems, and admirable sketch-maps of the railways and of the density of population give a clear view of the commercial development of the countries described. Special prominence is given throughout to British trade and British possessions.

We cordially commend the study of Mr. Chisholm's handbook to all teachers and commercial men.

Strathpeffer Spa : Its Climate and Waters, with Observations Historical, Medical, and General, descriptive of the Vicinity. By Fortescue Fox, M.D., London, etc. Illustrated. London : H. K. Lewis, 1889.

Though this handbook to Strathpeffer, "the Harrogate of the Highlands," has not been prepared with a strictly scientific purpose, it contains a great amount of local information which cannot fail to interest scientific geographers. The chapter on the climate, by Mr. Courtenay Fox, is a valuable monograph, on account not only of the facts and figures which it contains, but also of the meteorological problems which it suggests. Why is it, for example, that the difference in temperature between Strathpeffer and Greenwich is so much less during the night than during the day ? And why is it that the difference is so much less during Winter than during the Summer ? The difference between the minima is only 2·5 degrees, while that between the maxima is 11 degrees. During two recent Winters the lowest temperature recorded at the Royal Observatory has been actually lower than that recorded at the northern Spa. It is not very difficult to explain why the annual rainfall at Strathpeffer is only 28·9 inches, while that at Strome Ferry, only a few miles westward, is 65·30 inches ; but the two former questions are not so easily answered. Various explanations are attempted by the writer, but it is evident that even he is not quite satisfied with them. The chapter on the Geology and Botany of the district is also well done. The account of the vitrified fort on Knock Farrel is the best we have seen. There are also interesting descriptions of the scenery of the surrounding country, with notes on the antiquities, and on such unique phenomena as the Black Rock of Novar. The sensational padding, which is supposed to add to the value of the descriptive chapters, might have been omitted with the greatest advantage. The special information of the book, intended for medical men and for invalids, lies somewhat beyond our range, but it may be said that it is presented in a convenient and attractive form, and that it ought to have the effect of making the merits and attractions of the Highland Spa more generally known. It is, however, a not very creditable, and indeed a scarcely credible fact, that no complete chemical analysis of the sulphur waters for which

Strathpeffer is famous has been made since 1857. The maps and diagrams add to the value of the book. So much cannot be said for the pictorial illustrations.

Mackay's Guide to Oban. By ALEXANDER MAILER FAICHNEY. Oban: D. Mackay, 1889. With Maps. Pp. 128. *Price* 6*d.*

A well-constructed, practical guide, giving all necessary information of the country round Oban, and in regard to tours to Staffa, Iona, Glencoe, Loch Awe, Loch Etive, Ben Nevis, etc., with time-tables, and postal and other information. Oban is an admirable centre for excursions. The descriptions are brief—too brief in places—but as much as the average tourist will require. The maps are good—much better than one expects to see in guides of this price.

The Wild North Coast. Wick: A. JOHNSTON. *Price* 2*s.*

In this series of phototypes from drawings by the publisher a most successful attempt has been made to depict the romantic grandeur of the rock scenery of Caithness. The little album is a work of art, and will be welcomed by all who know the wild north coast, and by many who are unacquainted with its beauties.

Northern France, from Belgium and the English Channel to the Loire, excluding Paris and its Environs. Handbook for Travellers. By KARL BAEDEKER. With 9 Maps and 25 Plans. Leipzig: Karl Baedeker. London: Dulau and Co. *Price* 7 *Marks.*

It is somewhat singular that the region immediately opposite our own shores of the Channel should have waited so long for invasion by Herr Baedeker. Normandy and Brittany, the Ardennes, and the Vosges are among the regions most affected by British tourists in France; and those of them accustomed to travel with their Baedeker as their constant companion in other parts of the Continent must have missed the information supplied by their German "guide, philosopher, and friend." The *Handbook for Northern France* has all the characteristic features and merits by which the previous volumes of the series have attained popularity. That is to say, that while less ample on its historical and antiquarian, and less choice on its literary side than some other guide-books, it gives much careful and condensed information respecting distances, fares, and hours, the charges and accommodation at hotels, and other practical data valued by the traveller, and more especially the traveller who has an imperfect acquaintance with the language of the country. Following upon a brief introductory sketch descriptive of French history, geography, and institutions, Northern France is dealt with in three sections—the country between the Seine and the Belgian frontier, the district between the Seine and the Atlantic, and the region between the Vosges and Paris. Routes are laid down and followed, radiating from Calais, Paris, Metz, Caen, Brest, Besançon, St. Dié, and other centres; and the facts necessary for the traveller to know, if he would make his tour profitably and well, are gathered on the way. There are a few errors: we are told, for instance, in page 203, describing excursions into the Vosges from St. Dié, that the railway by which one proceeds from Rothau in the Central Vosges towards Strassburg "ascends"—it should, of course, be "descends"—"the valley of the Bruche." But these slips are not very important or staring. There is the usual excellence and profusion of maps of the sections of country, and plans of the principal towns.

Norway and Sweden. Handbook for Travellers. By K. Baedeker. With 23 Maps and 13 Plans. Fourth Revised Edition. Leipzig: Karl Baedeker. 1889. *Price* 9 *Marks.*

So far as we have examined this new edition of Baedeker's *Guide to Norway and Sweden*, we do not find that it has undergone any material alteration, beyond the correction of a few errors and the amendment of a few details, bringing it up to date. We have noticed for special remark the following points, which relate to parts of Norway that we have ourselves visited during the Summer that is now drawing to a close, our guidebook having been the *third* edition of Baedeker's *Norway and Sweden*. The new and now favourite route from Stavanger to Odde by way of Roldal is specially described in separate paragraphs. The fact that the Folgefond glacier can now be crossed by means of sledges from Sundal on the Mauranger Fjord to Odde is, of course, not alluded to, as it is only a few weeks old. The journey from Eide to Ulvik or *vice versa* is generally performed driving, though a considerable part of the distance has to be done on foot. At Ulvik, the *best* hotel, Fru Vestrheim's, ought certainly to be marked with a star. Strange to say, the guidebook makes no mention of the waterfall which is to be seen at the mouth of the Ose Fjord. In the description of the excursion to the Simodal (pp. 62, 63), the path after we have passed Gaarden Melhus, does not conduct "us along the right bank," but along the *left*. At the Buarbræ a small hotel has recently been built, and one is in process of erection just beyond Gaarden Skjæggedal: neither are mentioned in this new edition. In the interests of intending visitors, it is but just to state that Jacob Thörvi's inn at Marifjæren does not deserve to be marked with the star of recommendation. The charge for a stolkjærre from Marifjæren to Kroken or Faaberg in the Justedal is certainly not 8 kronor; it is almost double that amount, the distance there and back being close upon 60 kilomètres or 38 English miles. By the way, a new driving road is to be built, we were informed, up the Justedal, during the coming autumn. King Bele's tomb is now correctly stated to be about one kilomètre from Balholm, instead of six, as in the last edition. But even though we have so many omissions and corrections to note, we are nevertheless convinced that Baedeker's is, on the whole, the best guide-book in English the traveller can take with him, who intends seeing with his own eyes the wondrous scenery of "gamle Norge." And we do not speak without experience, for we have studied nearly all the guidebooks to that country which are now in the market.

The Hansa Towns. By Helen Zimmern. The "Story of the Nations" Series. London: T. Fisher Unwin, 1889. Pp. xvii. + 389. *Price* 5*s.*

The idea of including the Hansa Towns, their rise, progress, and fall, in this series, was a good one, especially as we believe the authoress to be quite justified in claiming that her work is the first English book dealing with the subject. Formerly any one requiring information in the English language concerning the Hansa towns had to be content with short, and not always satisfactory, encyclopædia articles; but we have now a book of more pretensions, and one that quite sustains the merits of the useful series to which it is the latest addition. On the whole, the work has been well done, although where matters of opinion crop up we cannot always agree with the writer. Matters of fact, however, have been very skilfully arranged, and the story is told in an exceedingly easy, pleasant manner. The quaint illustrations are a charming feature of the book, and even the architectural plates have an old-world feeling about them quite in keeping with the text. The map will be found useful for reference.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE COCOS-KEELING ISLANDS.

By H. B. Guppy, M.B., F.R.S.E.

Part III.

COCOS-KEELING OR KEELING ATOLL.

(*Conclusion.*)

The Lagoon.—On referring to the chart of this atoll it will be observed that a large portion of the lagoon is less than a fathom in depth. In truth, taking the area of the lagoon at 25½ square miles, 12 square miles would be appropriated by the deeper northern portion, which ranges in depth from 1 to 8 fathoms, and 13½ square miles would belong to the flats in the southern part, which, with exception of the pits that stud them, are at low tide either dry or covered by less than a fathom of water. For the convenience of description, therefore, we may divide the lagoon into two parts, the shallow southern flats and the deeper northern basin.

The Shallow Southern Flats.—These flats, along the inner or lagoon-margins of the islands are for the most part bare chalky mud-banks, dry at low water, and varying from 250 yards to a mile in width. The greater part of the area of the flats, however, is covered by a depth of water varying between a few inches and six feet at low tide. Corals usually grow in luxuriance over this shallow region and in the deep pits that here and there vary its surface; but in one or two localities, in the bight of South Island, the muddy bottom is clothed with thick felt-like masses of algæ. I have here referred to the *usual* condition of these flats, because in 1876 occurred an event, so well described by Mr. Forbes, that led to the destruction or rather death of the corals in most of the eastern half of the lagoon. Following a cyclone in January of that year, there welled out from the eastern margin between New Selima and Gooseberry Islands a fluid, of an inky hue and possessing a rotten sulphureous odour,

which within twenty-four hours destroyed every fish, coral, and mollusc in the eastern half of the lagoon excepting probably in the vicinity of Direction Island. Even three years after the occurrence Mr. Forbes described the poisoned area as "one vast field of blackened and lifeless coral stems, and of the vacant and lustreless shells of giant clams and other mollusca," with only here and there a young growing coral or a small living clam, and very few fishes. The poisoned corals would seem to have experienced some chemical change, since the blocks of a species of *Porites* employed by Mr. Ross for making hydraulic lime were in the poisoned state no longer available for the purpose.

The corals on the shallow flats naturally suffered most from the intensity of the destructive fluid, and even when I examined this locality twelve and a half years after the event much of it appeared a lifeless waste. The dead trunks and branches of the arborescent Madrepores that had once flourished here literally covered the bottom in places. Multitudes of the shells of *Tridacnæ*, rotten and decayed, strewed the ground; and even the pits still displayed on their bare slopes numbers of the dead detached plates of *Echinopora lamellosa* that once clustered thickly round their sides. Yet it was evident enough that the corals were in places beginning to resume their sway. Thus, the flats immediately south of New Selima have long since been clothed afresh with rapid-growing branching *Montiporæ* and other corals; and even where life seemed completely absent, a closer inspection usually discovered a few young growing corals and small living clams. However, at least a quarter of a century will have to succeed the event before the growth of corals can disguise the destructive effects of 1876.

I come now to the western half of the southern flats, a region which was not reached by the poisoned water. Here we find corals growing in great profusion, and until 1876 this was the general condition of the whole of the southern flats. However, although coral is very abundant, there are numerous interspaces of mud and sand, so that, probably, as Darwin similarly thought in 1836, not more than half of the area is actually clothed with living coral. The corals most abundant on the flats are the arborescent Madrepores, short-branched and massive species of *Porites*,[1] branching *Montiporæ*,[2] the foliaceous *Echinopora lamellosa*,[3] delicate white *Seriatoporæ*,[4] and *Pocillopora brevicornis*. This is a subject, however, to which I shall have further occasion to refer. Next to the corals I should mention the *Tridacnæ* of all sizes, from the full-sized *Tridacna gigas* downwards, which live in multitudes on the flats. The pits that stud the flats range in width from a few boat's-lengths to several hundred yards, and their depth varies from three or four to eight or nine fathoms. The

[1] The two most frequent of the branching species of *Porites* are *P. palmata* (?) which turns black on removal from the water, and *P. clavaria*, which in a similar manner assumes a dark brown hue.

[2] Especially *Montipora digitata*.

[3] Mr. Darwin, comparing this coral to an *Explanaria*, remarks that it has polyps on both surfaces. Many of the specimens, however, which I examined, bore the polyps on one surface only. Perhaps the double-backed forms may arise from the plates growing in a more vertical position.

[4] Considered by Mr. Darwin to be *Seriatopora subulata*.

deeper pits descend rapidly at an angle of not less than 45°, and their slopes are usually covered with the foliaceous *Echinopora lamellosa* to the exclusion of almost all other corals. The shallower pits are mostly occupied by thickets of Madrepores, their sombre hue varied by the white cloudy patches of *Seriatopora*, with here and there a solitary specimen of *Echinopora lamellosa* almost lost amongst the other branching corals.

The Northern Basin.—Numerous coral patches separated by extensive sandy intervals are growing in the basin, but I doubt whether more than one-third of the bottom is covered with living coral. The soundings are often very irregular, the usual depth being about 5 fathoms, but within a boat's-length the water may suddenly shoal to $1\frac{1}{2}$ fathoms and even less, or the lead may drop into a pit where there is a depth of 7 or 8 fathoms, so irregular is the growth of the coral. Massive species of *Porites* and the stout *Millepora verrucosa* appear to be amongst the more frequent of the corals that here thrive.

At the present time the only safe entrance for ships is that between Direction and Horsburgh Islands. The passage between the northern end of West Island and Horsburgh Island is divided into two channels by Turk Reef. The southern channel, where there is a depth of four fathoms, is unsafe even for small boats unless they are under the management of a person acquainted with the locality. On one occasion when I passed through this channel in the three-ton yacht of Mr. Ross, the water was quiet; but ten minutes afterwards a succession of huge rollers came up from the south-west, and after commencing to crest in 10 fathoms of water, they broke right across the channel and made its usually quiet waters white with foam. We had therefore to return by the channel on the north side of Turk Reef; but even this is not always safe for small craft. When there have been heavy gales in the Southern Ocean, the south-west rollers that break every fifteen or twenty minutes on the west side of this atoll are of still greater size, and break across the whole width of the passage between Horsburgh and West Islands. In truth the passage between these two islands is gradually being obliterated by coral growth, which is here very luxuriant, though mostly of the massive order. The process is well exhibited in the channel north of Turk Reef, which has been occasionally used by ships entering the lagoon, but now is dangerous although depths of 5 fathoms occur. Two curving lines of submerged reef, following the submarine contour, stretch across the inner part of this channel. They are separated by a sandy interval, $1\frac{1}{2}$ to 2 fathoms deep, which is dotted with clumps of *Millepora verrucosa*, 2 to 3 feet across, and perhaps about $1\frac{1}{2}$ feet in height, which, as Mr. Ross informed me, were not in existence thirty years ago. This locality affords an excellent example of the manner in which a reef extends seaward by throwing forward successive lines which may be fathoms deep, and are separated from each other by sandy intervals. In the course of time, as in this particular instance, the corals invade the sandy interspaces which become filled by the accumulation of reef *débris* and by coral growth, and the whole rapidly reaches the surface and forms a flat. In this fashion the passage between Horsburgh and West Islands will be in time obliterated. An island will be thrown up on Turk Reef, and a con-

tinuous reef-flat, such as now crosses the wide passage on the south side of the atoll, will connect Horsburgh and West Islands together.

The Age of Keeling Atoll.—This atoll, viewed as an organism, has its own life-history. It cannot, in truth, live for ever. It has had its birth, has long passed its maturity, and is now on the road to its ultimate effacement as an atoll. The fact that it is doomed to be filled up as ages roll by is the foundation on which I base my arguments. Accepting this fact, we can ascertain the span of life that lies yet before it by studying the agencies at present occupied in filling up its basin. When this is known we can throw the light of our observations back into the past history of the atoll, and by, at the same time, appealing to our knowledge concerning atolls in an earlier and less mature condition, we can penetrate the mystery that at present surrounds its age. Knowing the life-history of such an atoll, its future duration, and its probable past extent, we can point to any other atoll of similar size in the Indian and Pacific Oceans and obtain an approximate idea of its age, and with caution we may extend the reasoning to those of larger and of smaller size.

Nor is this all. After taking a comprehensive view of all reefs of this class, we shall be able to learn something of the duration of the present era of atolls by ascertaining whether the majority of these coral islands are in a state of maturity, or whether the most of them are young and still in the submerged condition, or whether, as in the case of Keeling Atoll, the greater number of them are approaching the stage of obliteration. We shall, in fact, be in a position to say whether we are in the commencement, in the middle, or at the close of the present age of atolls, and we shall be enabled with some confidence to gauge its duration. But with this unit of geological time presented to us in the life-history of an atoll, we shall be able to do more. We shall be in a position to ascertain in what parts of the oceans the oldest atolls occur, and this will naturally lead us to considerations concerning the ocean basins, their permanence or otherwise, and the stability or instability of their water-level. Other far broader fields of inquiry would open out, but I have said enough to indicate the general bearings of any conclusion concerning the age of these islands. The simple estimate of the duration of the life-history of an atoll is of little value in itself, but it derives a first-class importance considered as a measure of geological time. At some future time I may hope to consider the general bearings of this matter. In this paper, however, I have only to deal with Keeling Atoll.

It will be apparent to most people that any method for the calculation of the age of an atoll must of necessity be somewhat complicated, an intimate local acquaintance, an experience of the varied conditions of coral growth in other regions, and a general knowledge of the literature relating to the subject, being requisite qualifications on the part of the investigator for its success. My deficiencies in these respects I have done my best to remove, and I therefore enter upon the matter with some degree of confidence; but it should be remarked that the limits of this paper prevent me from giving much more than the general results I

have attained. The details are somewhat bulky, and all data, such as the densities of various corals, sands, muds, etc., and the different rates of growth of corals, were obtained by my own experiment and observation *on the spot*.[1]

I have already estimated that 5000 tons of sand and sediment, derived from the action of the breakers on the outer edge of the reef, are annually transported through the passages between the islands into the lagoon (Part II.). Nearly five-sixths of these materials are deposited at and near the margins of the lagoon within a zone not usually exceeding a quarter or half a mile in width. The remainder, consisting of the finest chalky mud, foraminifera, diatoms, alcyonarian spicules, etc., is carried well into the lagoon, and in unusually calm weather some of it may be seen floating on the surface in a scum of confervæ and other vegetable matter. The marginal zone, which receives nearly five-sixths of these materials, also receives constant additions from the decay of innumerable small crabs and shell-fish, a few corals, etc.; and as the combined result of these agencies I estimate that the mud-flats bordering the lagoon, which are either dry or covered only by a few inches of water at low tide, are advancing on the lagoon at the rate of 1000 *yards, or about half a mile in a thousand years*. The process is of course not always regular, but the currents in course of time distribute much of the sediment around the shores of the lagoon, and the effect produced is fairly uniform. On these mud-flats the islands also advance, but at a slower rate, pushing forward their inner or lagoon margins by the process of reclaiming described in Part II.

Passing beyond the marginal zone that receives most of the sand and sediment brought in through the passages, we come to the great southern flats themselves, which I have already described. Going back to the time before the irruption of the poisoned water in 1876, when corals flourished over the greater part of this area, and allowing for the mud-banks and the sandy interspaces, we should perhaps avoid exaggeration if we assumed that half of this area—namely, five square miles—was at that time covered with living coral.[2] One and a half square miles would be occupied by the Madrepore thickets and similar corals, one and a half square miles by the *Porites* group and massive corals, one square mile by the branching *Montiporæ*, and one square mile by the corals in the pits, usually *Echinopora lamellosa*. It must be remembered that each of these principal factors I take as including and representing other factors not mentioned. Together, I believe they illustrate the different agencies engaged in building up these flats.

I take first the arborescent Madrepores of more than one species, which grow in thickets attaining a maximum height of about six feet. From my observations and those of others, and from information supplied to me on the spot, I have good grounds for assuming that these thickets grow at the average rate of four to five inches in a year, and that they

[1] Since the local conditions vary considerably in different atolls, especially in those situated in distinct coral reef regions, the future investigator in this field should obtain *all his data on the spot*.

[2] Without the marginal zone, the southern flats cover about ten square miles.

will attain their full height in about fifteen years. Many of the main trunks are usually dead, whilst the branches are alive, and when one of these dead trunks, weakened by boring plants and animals, and by other causes, suddenly gives way, others in a similar condition follow, and the whole thicket, which may be several paces in width, is suddenly levelled to the ground, a result which I have experimentally produced. The sites of old Madrepore thickets, strewn with their broken branches and finer *débris*, are frequently to be seen in places where these corals grow in great profusion; and the observer can readily satisfy himself that these thickets grow on a bottom formed of the remains of many previous generations of Madrepores which have accumulated to such an extent that a boat-hook sinks some feet into a friable material. Now I assume from my observations that only a few years will elapse, after a thicket has attained its full size, before it comes to the ground; and I think, therefore, we may safely take twenty years as the usual duration of a thicket. Its *débris*, formed of the sand produced by the decay of its more friable parts, and of the fragments of the more compact branches, would raise the surface originally covered by the thicket between 2 and $2\frac{1}{2}$ inches, which represents a rate of about one foot in a century. I made similar observations in connection with several other species of Madrepores in this atoll that possess more thickly clustered branches, and do not exceed two feet in height, and arrived at results so similar to that obtained in the case of the arborescent Madrepores that I feel confident in accepting this rate of one foot in a century as indicating the part taken by the lagoon *Madreporidæ* in building up their portion of these great southern flats.[1]

Next we come to the group of the *Poritidæ*, which I estimate to cover $1\frac{1}{2}$ square miles of flats. The branching species, usually possessing short and crowded branches, are quite twice as numerous as the massive kinds, and I will assume that they occupy two-thirds of the area. Of the branching species the most frequent and typical is *Porites* (*palmata*?), which changes from a yellow to a black colour on removal from the water. Its level-topped clumps attain a maximum diameter of from 12 to 15 feet, and a height of from 2 to 3 feet. Before a clump has grown to half this size, it dies in the centre, which becomes coated with a Nullipore platform that bridges over the tops of the dead central branches. By the time the clump has reached its full size, the dead centre has fallen by the decay of the branches, and it presents the appearance of a ring enclosing a deep central cavity. Most of the lagoon corals with short closely-crowded branches go through this process when they attain any size; and it is only in rare instances that the patch of Nullipore incrusting the dead centre preserves the dead branches underneath until their interstices are filled with sand and other *débris*, when the clump is

[1] My method consisted first in measuring the ground covered by a typical specimen. Then, after weighing the coral, I determined by actual measurement the weight of a cubic inch of its materials. This gave me the bulk of the coral in a state of *débris*, and it was then easy to determine the rate at which the surface originally occupied by the living coral would be raised. A similar method, modified according to each special case, was adopted throughout my observations. Some of the corals, for instance, are preserved in a more or less complete condition, as in the case of the massive kind.

preserved entire. From my data I assume that this coral grows upwards at the rate of $1\frac{1}{2}$ inches in a year, but since such a large proportion of its mass rots away and decays, I think it will be safest to consider that it tends to raise the area it grows on in the form of sand. Its bulk when broken down into sand is only one-third of its mass as a living coral, so that the rate of growth of $1\frac{1}{2}$ inches in a year represents a raising of the surface of about half an inch in that period, and of about 4 feet in a century. To avoid an excessive estimate I will reduce this rate to that of 3 feet in a century.[1] This is three times as rapid as that computed for the branching Madrepores, but the mode of growth in either case is widely different; in the case of the Madrepores it is like that of a bush, whilst in that of the branching species of *Porites* the short branches are crowded together like so many fingers.

With regard to the growth of the massive species of *Porites*, I have been supplied by Mr. Ross with the necessary data for one of the commonest species in the lagoon, which in appearance resembles *Porites lutea*.[2] When not retarded in growth by the shallowness of the water, it grows in dome-shaped or round-topped masses that usually attain a diameter of 10 or 12 feet with a corresponding height. Taking its annual upward growth at only half an inch, this represents about 4 feet in a century. Most of these blocks are, I believe, preserved entire, but a few suffer partial decay. If reduced to sand, they would raise the surface about $2\frac{1}{2}$ feet in a century, and perhaps taking into consideration our limited acquaintance with the influences favouring or repressing coral growth, it would be best to accept an intermediate rate for these massive corals and place it at 3 feet in a century. These blocks, when growing in places where they are nearly exposed at low-tide, become flat-topped, and die and decay in the centre. In the shallow water of the flats one commonly observes flat-topped masses of this coral, about 12 feet across and 2 feet in height. Here the main growth has been lateral, and I estimate that each of these masses is about 125 years old.

I now come to the branching *Montiporæ*, of which *Montipora digitata* is most typical. These corals which cover extensive banks off the south side

[1] The other common branching *Porites* (*P. clavaria*) has a very similar habit of growth, and evidently levels up the surface at a similar rate.

[2] In October 1888 I measured the rate of growth of two masses of this coral originally weighing, in 1873, in each case 5 to 7 lbs., and probably measuring, judging from the specific weight of the coral, not more than 5 or 6 inches in height. One of them had grown to a height of 16 or 17 inches in a situation where it could not have been affected by the shallowness of the water, its weight in the wet condition being about 278 lbs., its form round but flattish on top, its vertical girth 5 feet 4 inches, and its horizontal girth 6 feet 7 inches, and showing little of decay. The other was crescentic or kidney-shaped, and had only grown to a height of 12 or 13 inches, its situation being less favourable for its growth; its weight when wet was 124 lbs., its horizontal girth 5 feet 3 inches, and vertical girth round the middle 3 feet 9 inches; covered with living polyps except at its concavity. It will be seen that, in the interval of fifteen years, the rate of annual upward growth of these corals was nearly $\frac{3}{4}$ of an inch in one case, and about $\frac{1}{2}$ an inch in the other. Mr. Ross had these corals replaced for future observation in a favourable position in October 1888; and with them were placed three small masses of the same coral varying between 5 and 10 lbs. in weight in the wet state. These data are noted in his copy of Mr. H. O. Forbes's *Eastern Archipelago*, on, I think, page 47.

of New Selima Island probably occupy about one square mile of the flats. Judging from the rate at which they have filled up a boat-channel excavated by Mr. Ross, I would place their annual upward growth at not less than 5 inches. They attain a height not usually exceeding 18 inches, and probably in about four years they attain their maturity, and commence to die. Some them are preserved entire, become incrusted with Nullipore in the centre of the clump, and have their interstices filled up with sand; but most of them go through the process of decay already described in the case of the branching species of *Porites*. Their style of growth is intermediate in character between that of the arborescent Madrepores and the closely-branched *Porites*. I estimate that successive generations of this coral would raise the surface with their *debris* at the rate of $3\frac{1}{2}$ feet in a century. The *Montiporæ*, in fact, are very important agents in filling up the lagoon.[1]

The last square mile is appropriated by the pits which are usually occupied exclusively by the large plates of *Echinopora lamellosa*, but as they get shallow they are invaded by the arborescent Madrepores. When uninterrupted in their growth, these foliaceous *Echinoporæ* grow with overlapping plates around a low stump formed by the attached bases of successive plates themselves, somewhat after the fashion of a huge *Polyporus*. After noticing carefully their mode of growth, and after numerous observations on their size, and on their specific weights both in the solid and in the powdered condition, I formed the opinion that these fragile foliaceous corals are very unimportant agents in filling up the lagoon. The relative size of two solitary specimens that I saw in the midst of the poisoned area—specimens which must have grown since 1876—enabled me to roughly estimate their rate of growth; and I ultimately arrived at the opinion that these corals do not raise the surface on which they grow more than 3 or 4 inches in a century. It is evident then that the deeper pits in which these corals exclusively reign owe their preservation to the corals themselves. In the first place, these holes were doubtless due to the irregularity of general coral growth in the lagoon in past ages; but as soon as the foliaceous *Echinoporæ* selected the early hollows for their abodes, they ensured by their slow growth the safety of their homes. Whilst the coral beds all around were building up at an average rate of not less than a foot in a century, the pits occupied by these foliaceous corals were shoaling at the rate of only 3 or 4 inches in the same period. In time, however, some of these pits commence to fill up rapidly for a while in spite of the conservative efforts of the *Echinoporæ*. "Runs" of sand occur down their steep sides, and arborescent Madrepores invade their area, until as the pits get shallower and shallower the *Echinoporæ* are almost ousted altogether, and the Madrepores interspersed with *Seriatoporæ* reign supreme.

We are now in a position, after assigning to each agency its due proportion, to ascertain the average rate at which the great southern flats, 10 square miles in area, have been built up by coral growth. We

[1] Amongst the miscellaneous corals not infrequent in the lagoon is *Pocillopora brevicornis*, which levels up the surface it grows on at a rate not less than a foot in a century.

have assumed that only half of this area is at one time actually covered with living coral, and putting all the results together we arrive at the conclusion that the corals on this area build up the surface they grow upon at the rate of two feet in a century. To apply this result to the whole of the southern flats we must halve it, and then we get an estimate of one foot in a hundred years. But corals, though by far the most important agents in building up a reef, are not the exclusive agents. Molluscs, including the huge Tridacnæ, add their shells in considerable numbers to the growing mass; and to allow for their co-operation I will adopt the suggestion of Professor Dana when speculating on this matter, and will consider that "shells add one-fourth as much as corals to the reef material."[1] I will make, however, this addition more comprehensive by including in it the more solid remains of numerous other living things that infest coral reefs, such as those of crustaceans, fish, alcyonarians, the corallines, calcareous algæ, etc. Thus we make the rate of increase for the whole of these flats $1\frac{1}{4}$ feet per century; but this estimate requires further modification, since we have not yet considered the retarding influences of coral growth.

As the most disastrous of these influences I will refer to the welling up in vast quantities of dark water in 1876, by which almost half of the coral in the lagoon was killed. For at least a decade nearly half of the area was a waste, and there was almost a complete cessation from labour on the part of the coral polyps in the poisoned part of the lagoon. At least a quarter of a century will have to follow the catastrophe before the wonted activity of the little builders will be restored. I have found, however, no evidence that a like event has occurred since the atoll was first occupied some sixty years ago. Mr. J. C. Ross writing of his own islands in 1855 makes no reference to such an occurrence;[2] and it should be remarked that huge masses of *Porites*, that must have been more than a hundred years in age, and large *Tridacnæ*, with shells more than three feet in length, that had probably been alive for an equally long period, were destroyed by this poisonous water. It is evident, therefore, that events like those of January 1876, being rare in time though frequent perhaps in the lapse of ages, must have no very important repressive effects. Occurrences, however, on a much smaller scale are not infrequent, and some of them have been recorded by Darwin and Forbes. The long continuance of heavy rains is often destructive of corals near the surface in the southern part of the lagoon. After standing for some time in the interior of the bigger islands, the fresh water drains off into the lagoon in a semi-putrid condition, and fish and corals are by this means at times destroyed. Then, again, during a particular wind-season the tides may have been unusually small, allowing the surface corals to grow a few inches above their general level. When the season changes, the tides assume their usual rise and fall, and the extra few inches of coral become permanently exposed, and the result may be a field of dead

[1] *Corals and Coral Islands* (1872), p. 251.

[2] "Review of Mr. Darwin's Theory of Coral Formations," published in the *Natuurkundig Tijdschrift voor Nederlandsch Indie*, deel VIII., Batavia, 1855.

coral. At times, again, the thick felt-like masses of algæ found in the bight of South Island are washed up on the shore of the lagoon in large quantities by a heavy north-westerly swell, and there they rot, and by tainting the water injuriously affect the corals. At most times, however, these vegetable masses in this locality render the water in their vicinity too impure for coral growth and give it a rusty hue.

It will have been noticed that these lesser catastrophes only affect the corals near the surface, and their results do not extend far beyond the margins of the lagoon. They can but little affect the general coral growth, and in the earlier history of the atoll they could have but little delayed the building up of the southern flats. Mr. J. C. Ross, in fact, in the paper before quoted, dwells on the local effect of such occurrences as unusually heavy rains, and confirms my opinion concerning their unimportant influence on general coral growth.

There is, however, another retarding influence to reef-growth and that is the solution of the dead coral in sea-water. I do not, however, consider this as a very effectual repressive agency in the present closing scene of the atoll. The accumulation of coral *débris* is too patent a fact. When we walk through a field of madrepore and sink knee-deep into the friable *débris* of many preceding generations of this coral, we realise the fact that dead coral accumulates and is but partially removed in solution. The residents year by year see their favourite anchorage shoaling by some rapid growing coral that finds on the *debris* of preceding generations a suitable station. Still there can be no doubt, as shown by Murray, Irvine, J. G. Ross and others that the solvent action of sea-water has a repressive effect on the rate of reef-growth, and to allow for its agency and also for the other retarding influences before enumerated, I will reduce my estimate for the building-rate of the great southern flats by one-fifth which will make it *one foot in a century*. Probably this rate is in excess of the growth of the corals on the flats at the present day, since they are exposed to the repressive influence of shallow water. My observations, however, were made on corals growing under normal conditions and unaffected by the shallowness of the water, and the estimate, therefore, represents the historical rather than the existing rate of the building up of the great southern flats now mostly covered by less than a fathom of water.

It is now necessary to obtain some data with reference to the basin occupying the northern half of the lagoon. I have already spoken of the proportion of sand to coral being at least two to one.[1] Its bottom is

[1] It is probable that only a small proportion of the sand in the interior of the lagoon has been derived from the materials transported through the passages. Five-sixths of the 5000 tons annually carried into the lagoon are deposited, as I have already remarked, near the margins, and the remainder would only raise the general surface of the interior at the rate of one foot in 1700 years. The greater part of the sand away from the vicinity of the margins of the lagoon is first produced by the degradation of dead coral through the agency of the boring-molluscs, annelids, echinoids, sponges, etc., which there find a home. The trituration of the coarser sand and gravel is effected in the digestive systems of the echinoderms, crustaceans, molluscs, fish, and other organisms that swarm upon a reef. The solvent agency of sea-water evidently prepares the way assisted by the decay of the animal matter. Mr. Darwin held the opinion that the Holothurians, which live in great numbers on a reef,

very irregular, and numerous coral patches seriously obstruct its navigation, some of them, as in the case of Dymoke Shoal, rising to within a fathom of the surface, whilst others are awash at low-tide. When we come to consider the changes that have occurred in this atoll since it was first occupied some sixty years ago, we enter on very uncertain ground. The present chart of these islands is of little use for this purpose, since it is merely Captain Fitzroy's plan of 1836 to which only a few additions have since been made. In it the shoals and shallow patches are with few exceptions marked just as they were half a century ago, and in truth to obtain any comparative results of scientific value another Admiralty survey is absolutely necessary. In the plan of these islands reproduced by Mr. Forbes in his *Eastern Archipelago*, the author endeavoured to indicate the changes that took place in the atoll between the *Beagle's* survey in 1836 and his own visit in 1879; but the most reliable results can only be obtained by the comparison of two Admiralty surveys. Even under such circumstances great caution will be necessary so as not to regard as recent changes what may only have been omissions in the previous survey. Thus, with reference to the lakelet or lagoonlet in Horsburgh Island, it might be inferred that it has recently been formed, because it is not found in the original plan of 1836 (given in the third volume of Fitzroy's *Voyages of the Adventure and Beagle* (1839)). As a matter of fact, however, it is marked in Van der Jagt's plan of 1829.[1] This last plan will be found very useful in association with Fitzroy's chart when a comparison between the past and the present comes to be made. Mr. Ross has also in his possession a sketch of these islands made by his grandfather about 1825.

I followed up the two lines of soundings carried by the officers of the *Beagle* across the basin, and came to the conclusion that whilst the general shallowing since 1836 has been slight, the growth of coral patches has been in some places rapid. This is evidently the mode by which the basin of the lagoon will be filled up, and it will be undoubtedly a slow one. In the space of half a century the sandy intervals will shoal but little, whilst the coral patches may rise up considerably.

General impressions concerning changes in an atoll are often not reliable.[2] It would be folly, for instance, to conclude that a lagoon was

actually browse on the living coral (*Coral Reefs*, 1842, p. 14). Nearly all other observers, such as Dana, A. Agassiz, Semper, Saville Kent, etc., have controverted his view, and I have never myself seen an instance of the kind. This subject I have treated at length in a paper on the Solomon Island reefs (*Proc. Roy. Soc. Edin.*, 1885-86, p. 894).

[1] *Verhandel. Batav. Genootschap der K.*, Batavia, 1832.

[2] Whilst in these islands I was led to believe that during the last sixty years vessels had been gradually crowded out of the centre of the lagoon-basin by the growth of coral and that now Port Refuge was alone left to them. However, I find that the anchorage recommended has always been in Port Refuge, except when, as in the early days of Van der Jagt and others, an anchorage off the NW. side of Direction Island, outside the lagoon, has been also suggested. In the plan of Van der Jagt of 1829, in that of Keating of about the same date which is given in Holman's voyage, in a sketch-map, apparently by Captain J. C. Ross, which accompanies a description of these islands published in the second volume of *Gleanings in Science* in 1830, and in Fitzroy's chart of 1836 we find the anchorage marked within Port Refuge and usually near the entrance or under Direction Island. In truth it was not considered safe in those early days, except in case of war, for a vessel drawing

rapidly filling, merely because within a few years a boat-channel became choked with some rapid-growing *Montipora* or *Madrepora*, a possible mistake, which, however, did not entrap the young naturalist of the *Beagle*. I have endeavoured to show in this paper that any mode of estimating the rate at which a lagoon fills must of necessity be somewhat complex, and Dana long since pointed this out with reference to general reef-growth (*Corals and Coral Islands*, 1872, p. 249).

The best way to obtain an estimate for the rate of the filling up of this basin will be to employ the data we have already obtained in the case of the southern flats, assigning, however, a much more important part to the massive corals. Of the 12 square miles of its area, I assume that only 4 square miles are at any one time occupied by living coral. Half of the coral area would be occupied by massive corals (of which the prevailing species of *Porites* may be taken as types) that would shoal the waters at the rate of 3 feet in a century. The other half, covered with millepores, stout-branching corals, as *Isopora labrosa*, and a variety of other corals, and numerous reef organisms, would probably shoal at the rate of $1\frac{1}{2}$ feet in a century. This gives a rate of $2\frac{1}{4}$ feet in the time for the whole coral area, and a rate of three-fourths of a foot per century for the total surface of the basin. Taking the average depth at 5 fathoms, the lagoon would be, for the most part, filled up at the end of four thousand years.

But in fact the process will be more rapid, though less simple in its operation. Whilst the basin is slowly shoaling, the great southern flats will be rapidly encroaching on its area. Upon their advancing slopes corals grow very luxuriantly, and more abundantly than on the flats, and their building-rate would probably be not less than $1\frac{1}{2}$ feet in a century. After examining the locality and character of these slopes, I have arrived at the conclusion that during the next twelve hundred years these southern flats will advance about two-thirds of a mile. During that time the basin will have shoaled about $1\frac{1}{2}$ fathoms, and the next advance will be considerably more rapid, so that in about two thousand years from the present time, the edge of the southern flats will be in all likelihood within half-a-mile of Dymoke Shoal. Meanwhile all the sides of the basin will be closing in. The passage between Horsburgh and West Islands will have long since been closed, partly through coral growth and partly through the constructive agency of the breakers. There will be an island of some size on Turk Reef, and a continuous reef-flat joining it on either side with Horsburgh and West Islands. The northern basin itself, that at present occupies half of the lagoon, will probably be not more than a mile wide and a couple of fathoms

more than twelve feet of water to sail up into the lagoon (*Ibid.*). Two Dutch navigators, J. J. Duintjer and J. W. Retgers, who visited these islands in 1842 and 1844, anchored within Port Refuge (*Verhand. . . . het Zeewezen*, Amsterdam, 1844 and 1845). In fact, it has never been the rule for vessels to anchor well up in the lagoon, except in the case of the island schooners. It is true, however, that in this instance Mr. Ross has within the last few years had to anchor his schooners within Port Refuge owing to the difficulty of keeping the anchorage off the Settlement clear of coral; but this is the only reliable evidence I can find to support the idea that vessels have been crowded out of the lagoon.

deep, and its size then will probably be roughly indicated by the dotted line that in the present chart defines the anchorage. The greater part of the present southern flats will then be covered with the mud-banks, and on these banks the islands will have advanced their margins half-a-mile or more. The great southern passage, between South and West Islands, will then be blocked up, and probably these two large islands will be joined; whilst, without a doubt, many of the islands on the east side of the atoll will then be united.

Such will be the condition of this atoll two thousand years hence; but the process then will be by no means complete. Most of the present northern basin will be in the existing condition of the great southern flats, covered by less than a fathom of water, and studded here and there with deep holes; and there will still be the shallow basin of the dimensions, and in the situation of the present anchorage. Another thousand years will probably elapse before the interior of the atoll is in a condition of *terra firma*; yet even then we shall find many of the pits represented by lakelets of salt water. But the salt water will be brine, the effect of ages of evaporation since the lakelets were cut off from the sea; and around their borders will be deposited great quantities of salt marking their diminishing size as time progresses; and in their briny waters, stronger than any artificial brine, will be found dead fish in an excellent state of preservation, "sweet and wholesome."[1] What a contrast will these fields of salt, and these lakelets of brine, with their pickled fish, present to the departed beauties of this coral atoll! One would scarcely realise then that there was a time when shoals of fish

> "Grazed the sea-weed their pasture, and through groves
> Of coral strayed, or sporting with quick glance
> Showed to the sun their waved coats, dropt with gold."

In time, however, the fields of salt and the briny lakelets will be replaced by extensive deposits of gypsum, such as occur in some of the obliterated atolls of the Central Pacific, Jarvis's Island to wit. No guano will probably be formed in this island, such as we find in the ancient uninhabited atolls of the Central Pacific, just alluded to, since the frigate-birds, the gannets, and the boobies, will be scared away by the presence of inhabitants, who, if they are the descendants of Mr. Ross, will have already effected the third renewal of the original lease of one thousand years. But little vegetation will grow on the sterile soil in the central area of the obliterated lagoon. Here and there will be found some scrubby grass or a patch of brushwood or a thicket of low leafless trees, and in this condition the surface will remain for ages. Should it be my fate to visit this spot again in that distant epoch, my vessel would anchor outside the atoll in a deep and sheltered bay of its north-west shore, formed on the north by the extension of Horsburgh Island for a mile or so along the submarine bank that trends away to North Keeling Island, and on

[1] This is no fanciful picture of the future condition of this atoll. It is in reality taken from a description of Christmas Island, in the Pacific Ocean, by Captain Hooper in 1858 (Rosser's *North Pacific Pilot*, Part II. p. 274 (1870).) This obliterated atoll well represents the future state of Keeling Atoll.

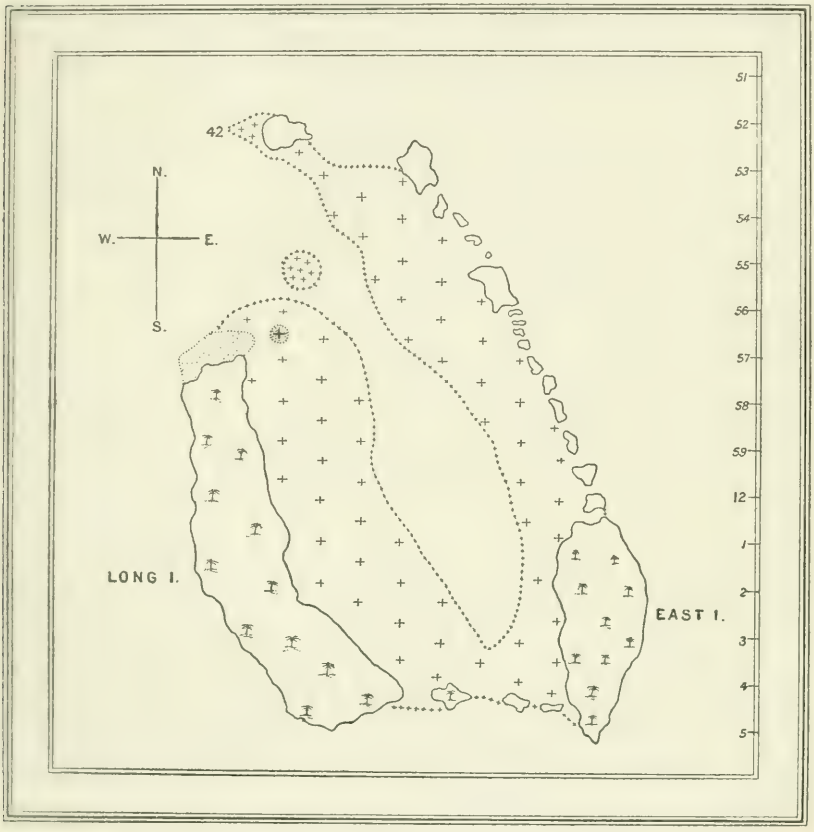
the south by a continuous wooded coast marking the closed-up passage between Horsburgh and West Islands.

I must now attack the problem of the previous age of this atoll, and endeavour to ascertain what period of time has elapsed since, as a submerged coral bank, it first lipped the waves. A certain familiarity with coral reefs, and with the charts of coral islands enables me to recognise in this coral island an atoll that, as regards the size of its lagoon, is entering on the last quarter of its history. We have estimated that it has at least another three thousand years before it, but probably the last stage will be rather more rapid, and in duration it may only represent one-fifth of the total life of the atoll, which, in that case, would extend over a period of fifteen thousand years. It must, of course, be remembered that an atoll can never be in a stationary condition. From the time when its margin is only indicated by the foam of the breakers to its mature stage when, as a ring of wooded islands surrounding a lagoon, it presents "a quiet scene of wood and lake," admirably set off by the contrasting ocean (Dana), its interior must be ever shoaling through coral growth.

We may attack the problem of the age of this atoll in another way, by assuming from the data I have collected that from its first appearance at the surface, when the lagoon had probably a maximum depth of 30 to 35 fathoms, to the final obliteration of its basin, it would be filling up at the average rate of a foot in a century. This would give its life-history a duration of about twenty thousand years. Again, assuming that the southern flats have a depth of 25 fathoms of coral *débris* beneath them, or a thickness of 150 feet at their edge, they would require a period of fifteen thousand years for their formation, if, as is probable, the average building rate has been one foot in a century. Supposing, however, that they had built themselves up half as rapidly again, say $1\frac{1}{2}$ feet in a century, they would require then a period of ten thousand years. Their origin would, of course, begin with the first appearance of the atoll, and if we add to these estimates the three thousand years which the atoll has yet to run, we obtain a life-history of eighteen thousand years in the one case, and thirteen thousand years in the other. On the whole, therefore, I should be inclined to say that, from its first appearance at the surface to its final obliteration, this atoll will require *a period of between fifteen thousand and twenty thousand years.*

On the Discovery and Early History of these Islands.—The discovery of these islands is usually attributed to Captain William Keeling during his return from Bantam in 1609; but I have failed to find any reference to such a discovery in the narrative of the voyage given by Purchas, Prevost, and other compilers of the early voyages. It is, however, evident from the accounts there given that his homeward track lay in the vicinity of these islands. That the discovery was made by the English, and probably by Keeling, is shown in the circumstance that these islands are laid down in Dudley's *Arcano del Mare*, published in 1646-47, where it is expressly stated that they were discovered by the English. In the maps of this atlas their size is much exaggerated, but their position, about 500 miles SW. of the Sunda Strait on the 11th

and 12th parallels, leaves no doubt as to their identity. The northernmost in the text and in two maps is named Killing Island (in one instance Riling I., evidently a misprint), the present North Keeling Island; whilst the islands of Keeling Atoll indicated by three wedge-shaped islands are named in this ancient atlas the Triangular Islands. Both Killing Island and the Triangular Islands are stated to have been discovered by the English, and it would almost appear that they were



EARLY DUTCH CHART OF KEELING ATOLL.

From the sixth volume of Van Keulen's Atlas, Amsterdam, 1753, p. 19. In the original chart occurs the following note:—"All very low and steep-to, except where 42 is marked, and thus entirely inaccessible." North Keeling Island is also there included.

independent discoveries. But this is not the first appearance of these islands in the charts of the old cartographers. They are correctly placed, but without a name, in Blaeu's appendix to the *Theatrum Orbis Terrarum* of Ortelius, which was published at Amsterdam in 1631. In the earlier editions of this atlas, those of 1606 (London), and 1570 (Antwerp), the situation of these islands is represented by a blank.

Strange to say, the Dutch, doubtless for good reasons, have never accepted the name of Keeling for these islands. In one of the maps of a large atlas published at Amsterdam in 1659, they are called the Cocos Islands, and this is the name by which they are always known in the Dutch charts of last century, such as those of the celebrated house of the Van Keulens; and it is remarkable that in most, if not all, of the French marine and general atlases of last century, those of Delisle (1700), Vaugondy (1757), Bellin (1764), D'Anville (1786), etc., they bear this name of the "Cocos Islands." The English hydrographers, however, preferred the name of Keeling; but it is noteworthy that Thornton in a map of the world given in his *Oriental Navigation* of 1703, and of later dates, writes the name as Kelling. Dalrymple in his charts and writings of about a century ago, refers to these islands under both names; and Horsburgh, the hydrographer of the East Indian Company, followed in his steps. All the evidence, therefore, derived from English geographers of the 17th and 18th centuries points to Keeling as the discoverer, and it is noteworthy that I did not find these islands laid down in any of the maps I examined of a date prior to that of Keeling's voyage.

During last century the passing navigator occasionally landed on these islands, but few if any of them trusted their vessels in the unsurveyed waters of the lagoon. The earliest description I have found occurs in the sixth volume, published in 1753, of Van Keulen's *Zeefakkel* (page 19), where they are described as low and wooded, reef-girt, with the appearance of deep water inside, and as possessing an abundance of cocoa-nuts, but no inhabitants; "so that it would seem," as the account naively runs, "that nature herself has produced these trees." In a plan of these islands which occurs in this volume, there is a note to the effect that they are "all very low, and steep-to, except where 42 is marked (off the west end of the present Horsburgh Island), and therefore entirely inaccessible." Further on in this paper I refer to the interest connected with this map with regard to the changes in this atoll. I need scarcely point out that its date must be prior to 1753, when the sixth volume of Van Keulen's atlas appeared. Mr. G. D. Bom, a member of the firm that has succeeded the ancient house of the Van Keulens of Amsterdam, informs me that it was made in 1729-30 by Jan de Marre, the noted Dutch navigator and poet, when in command of the *Heesburg*. I have, however, not yet obtained the necessary reference.

Coming to the early part of the present century we find, according to Keating,[1] that these islands were temporarily occupied in 1825 by Captain Le Cour of the brig *Mauritius*, his name, together with those of his crew, being found on the cocoa-nut trees by subsequent visitors. However, in December of this year Capt. J. C. Ross in the *Borneo*, a ship belonging to Hare and Son of London, took formal possession of these islands, and after first returning to England to consult with his firm, he settled here with his family in November 1827. During his absence Mr. Hare, a brother of one of the partners, established himself

[1] *Holman's Voyage*, iv. 371.

here, and there ensued on the arrival of Capt. Ross a period of dual rule in the islands, Mr. Hare asserting that he had previously asked Capt. Ross to examine the islands for him, whilst Capt. Ross maintained that he understood Mr. Hare to have referred to Christmas Island. However, after some years, Hare departed for Singapore. Meanwhile these proceedings had attracted the attention of the Batavian authorities, and in October 1829 arrived Mynheer Van der Jagt in the *Blora*, appointed as commissioner to make a report on the islands.[1] The Dutch commissioner was followed by Capt. Sandilands, who arrived in H.M.S. *Comet* in the following February (1830) for the purpose of inquiry. I have not been able to discover his report; but in the succeeding October an account of these islands, derived, as the editor remarked, from official documents, was published with a sketch-map in the second volume of *Gleanings in Science*, a Calcutta publication. This is the most complete of all the early accounts of these islands, and evidently most of its information was originally derived from Capt. Ross himself. A short paper from Rear-Admiral Owen, identical, as far as it goes, with the preceding, was read before the Royal Geographical Society, and was published in the first volume of their Journal (1831). In 1836 Capt. Fitzroy and Mr. Darwin arrived in H.M.S. *Beagle*, and the islands were properly surveyed. The descriptions both of Capt. Fitzroy and of Mr. Darwin are to be found in Fitzroy's *Voyages of the Adventure and Beagle*. Subsequently other accounts of these islands were given by Mynheer J. J. Duintjer in 1842, and Mynheer J. W. Retgers in 1844.[2] However, neither the Dutch nor the English could be persuaded to take the islands over until 1878, when they were definitely placed under the Government of Ceylon.

The early Dutch map of Keeling Atoll, attributed to Jan de Marre, 1729-1730. This map, as I have remarked, was published in Van Keulen's atlas in 1753. Though on an exaggerated scale, the plan is in many of its main features correct; but it is apparent from the form given to East Island (the present South Island) and from the great extension of the basin of the lagoon, that those who made the plan could not have entered very far into the lagoon. Disregarding the errors, which are inseparable from what is merely a sketch of these islands, we may safely conclude, on making a comparison with the present condition of the atoll:—

(*a*) That for a century and a half Turk Reef has been awash with the breakers without the formation of an island upon it.

(*b*) That 150 years ago the larger islands were as entire as they are now, and were not divided by passages.

(*c*) That no new island has been formed in this period, and that with the exception of Workhouse Islet, the islands possess the same relative size as when the plan was made.

(*d*) That 150 years make but little alteration in an atoll.

[1] This report is given in vol. xiii. of *Verhand. Bataviaasch Genootschap der K.*, Batavia, 1832.

[2] *Verhand. . . . het Zeewezen*, Amsterdam, vols. for 1844 and 1845.

Summary of the conclusions arrived at in this paper.

(*a*) That these islands possess a very salubrious climate. (Part I. pp. 282-284.)

(*b*) That besides pumice there has been drifted to these islands a huge volcanic bomb. (Part I. p. 286.)

(*c*) That large blocks of floating corals have been stranded on these islands. (Part I. p. 287.)

(*d*) That the lagoon of North Keeling Island has always been shallow and was formed after the reef reached the surface, by islands thrown up on its margins and subsequently united. (Part I. p. 294; Part II. p. 466.)

(*e*) This small atoll of North Keeling, when compared with the neighbouring large atoll, exemplifies the relation, dwelt upon by Murray, which exists between the periphery and the superficial area of the lagoon in atolls of different sizes. A small atoll not a mile square, as North Keeling Island, can have never had a deep basin on account of the large amount of sand carried into its lagoon from its relatively great extent of outer reef.

(*f*) The growth of corals in the lagoon is probably affected by the variations in the surface-temperature of the water. Whilst the temperature in the centre of the lagoon is nearly constant during the day, that of the waters near the margins varies considerably, being 2° to 3° F. cooler in the morning than the central temperature and 4° to 5° warmer in the evening. This variation, as already shown (Part I. p. 284), affects the climate.

(*g*) That when a section of an atoll is drawn on a true scale it is shown to be merely a level patch of coral reef with a slightly raised border, and has no basin in the true sense of the word. (Part II. pp. 457, 458.)[1]

(*h*) That a reef grows outward on its own talus rather by jumps than by a gradual outward growth. (Part I. p. 294; Part II. p. 461.)

(*i*) That the islands have three modes of increasing their extent. They may *advance seaward on the reef-flat by the formation of successive ridges of reef-débris* thrown up by the wash of the breakers. Their *extremities are extended and curved lagoonwards* by the sand and *débris* carried in by the currents through the passages between the islands, which thus become crescentic in form. After several of these horse-shoe or semi-crescentic islands have been united into larger islands, *their inner margins advance on the lagoon by a reclaiming process*, the bays or lagoonlets being gradually silted up through the reclaiming influence of the bush-covered bars or banks that more or less cross their mouths. (Part II. pp. 463-475.)

[1] Captain Fitzroy gives sections of this atoll in his *Voyage of the Beagle, etc.*, which afford a good illustration of the true dimensions of an atoll. He, however, makes the seaward slope less rapid than I have done in my section.

(*j*) That all the original islands on the reef tend to assume the crescentic or semi-crescentic form through the extension and curving lagoonwards of their extremities by the deposition of the sand carried in by the currents over the reef, just as a stake in a river's bed gives rise to a V-shaped ridge of sand (Part II. p. 472); but that when such islands join to form the larger islands, their original crescentic form is often disguised.

(*k*) That the passages once dividing the larger islands have not been filled up within the last 150 years. (Part II. pp. 467, 469, and Part III. p. 585.) Mr. G. C. Ross, who succeeded his father in the proprietorship of the islands, remarking in 1855 on the antiquity of these passages, observed that they must have been closed before Europeans first doubled the Cape. He had a copy of the old chart which Mr. Liesk described to Mr. Darwin as exhibiting South Island cut up into a number of islets (*Coral Reefs*, 1842, p. 15). Though without date, the old chart had the appearance of having been made in the early part of last century. It was the opinion of Mr. Ross that it had been sketched some distance out at sea, when, from the relatively smaller height of South Island at the sites of the original passages, these portions of it would be below the horizon.[1]

(*l*) That at least 5000 tons of sand and *débris* derived from the breaker-edge of the reef are annually transported by the currents through the passages between the islands into the lagoon, nearly all of which is deposited at and near the lagoon's margin. (Part II. p. 474.)

(*m*) That of the whole area of the lagoon, about $25\frac{1}{2}$ square miles, only about 9 square miles are usually covered with living coral. (Part III.)

(*n*) That catastrophes like that of the irruption of poisoned water in 1876, through which nearly half of the corals in the lagoon were killed, are rare in time, though frequent perhaps during the lengthened life of the atoll. Some of the massive corals, then killed, must have been more than a century old. Such an event has not happened before within the memory of the present proprietor, and no such occurrence was referred to in 1855 by his father when writing of his own islands in his criticism of Mr. Darwin's views. (Part III. p. 577.)

(*o*) That whilst arborescent Madrepores in the lagoon do not raise by their *débris* the surface on which they grow more than a foot in a century, the massive species of *Porites* fill up the lagoon at three times that rate. (Part III. pp. 573-575.)

(*p*) That branching Madrepores and *Montiporæ*, and branching and massive species of *Porites* are the principal agents engaged in filling up the lagoon.

(*q*) That the deep pits in the lagoon owe their preservation to the foliaceous corals that appropriate them. (Part III. p. 576.)

[1] *Natuurkundig Tijdschrift voor Nederlandsch Indie*, deel. VIII., Batavia, 1855.

(*r*) That the great southern flats have been built up at the rate of a foot in a century, and that they are at present advancing on the deeper part of the lagoon at the rate of $\frac{2}{3}$ of a mile in 1200 years. (Part III. pp. 578-580.)

(*s*) That the deeper parts of the lagoon are not shoaling at a faster rate over their whole surface than $\frac{3}{4}$ of a foot in a century. (Part III. p. 580.)

(*t*) That the total life-history of this atoll will cover a period of between 15,000 and 20,000 years, and that it has yet another 3000 years to run before the obliteration of the lagoon is complete. (Part III. p. 582.)

(*u*) That the main features of this atoll change but slowly in the course of centuries. (Part III. p. 585.)

(*v*) That neither of upheaval nor of subsidence is there any evidence of an unequivocal character. After an existence of many thousands of years, the islands still retain their low elevation, due originally to the constructive action of the breakers assisted by the accumulation of blown sand; so that there is scarcely room for the belief even if the evidence of upheaval apparently existed. The apparent signs of subsidence to which Mr. Darwin alludes, were otherwise explained by the late Mr. J. C. Ross when he somewhat vigorously took up the cudgels in 1855 on behalf of the stability of his own atoll. In his paper, which is referred to on page 587, he gives the same explanation which his son, Mr. G. C. Ross, the present proprietor, also pointed out to Mr. Forbes and to myself. Both ridicule the idea of deducing a movement of subsidence from such flimsy evidence as Mr. Darwin advances. During their lifetimes on this atoll there have been in some places, owing to the gales and the local currents, temporary encroachments of the waters of the lagoon, during which cocoa-nut palms have been undermined and brought to the ground; but more often the contrary has occurred, and we can point to many a clump of young cocoa-nut palms which they have planted on ground naturally *regained* from the lagoon. If Mr. G. C. Ross were to follow his father's example and give to the world his own ideas on Keeling Atoll, he would write with a greater authority to be heard than could be claimed for any one who has visited these islands. In truth, without the advantage of his experience, I should have missed over much that was important.

(*w*) All the evidence goes to show that these islands were never inhabited before the early part of this century; but it would seem that cocoa-nut palms have abounded on them ever since their discovery in the early part of the seventeenth century.

Note.—If I should be able to throw further light on the discovery of these islands, I may, with the Editor's permission, send a few lines on the subject to a future number of this Magazine.

My observations on the stocking of these islands with their plants are embodied in a long paper at present before the Council of the Victoria Institute, London.

ON THE TEMPERATURE OF THE TIDAL ESTUARIES OF THE SOUTH-EAST OF ENGLAND.

By H. C. Sorby, LL.D., F.R.S.

(Presented, through Committee on Seasonal Variations of Temperature in Estuaries, to the British Association, Newcastle Meeting.)

Whilst living on board my yacht, the *Glimpse*, for five months in summer during each of the last ten years, I have devoted a good deal of attention to the number per gallon of water of the small, free-swimming animals and plants. It was soon found that this number varies enormously, the average from the surface to the bottom being sometimes a thousandfold what it is in other cases. It appeared to me so probable that this difference might in part be due to variations in the temperature, that I thought it desirable to study the question carefully, and the more so, because such a systematic examination had probably not been carried out previously. The temperature of the water has been determined by the same thermometer throughout the entire period, being one of Negretti and Zambra's reversing deep-sea instruments, and that of the air by two different thermometers, the errors of which were known. I may say that I have done my best to correct the final results, so as to make all the temperatures comparable; but, at the same time, it must be borne in mind that almost all the conclusions of importance, in which small errors might be of consequence, depend entirely on *differences* of temperature, as measured by the same thermometer, within a range of only a few degrees, under similar circumstances, so that any serious errors would be avoided.

These observations of temperature have formed only one branch out of many subjects of inquiry carried out on the yacht, and in many cases have necessarily been neglected for others; and in some years I was living for months in inland waters, or otherwise unable to systematically study the temperature of the sea-water. My results are, however, fairly complete for three seasons, viz., 1884, 1885, and 1888, whilst those for 1886 and 1887, though defective in certain months, are otherwise valuable at critical periods.

The system adopted was as follows:—The temperatures of the water at the bottom and at the surface, and of the air on deck, were determined at high water and at low water. There are many advantages in this system, as applied to estuaries. The water then is comparatively at rest, and at high water and low water we have the two extreme variations in the kind and number of the free-swimming organisms, and in the amount of salts in solution; and also at certain seasons an interesting and important average difference in temperatures. It was not found convenient to observe these temperatures before five A.M. and after nine P.M.; but between those hours, during each tidal period, it is most days possible to make two observations at, or sufficiently nearly at, low water, which continues for some time, and one at high water, or two at high and one

at low. Such observations not only enable us to determine the average temperatures, but also furnish the means for ascertaining the cooling effect of the night and the heating influence of the day.

The district specially studied extends from the Straits of Dover up the Mouth of the Thames of the charts, to the West Swale and Chatham; thence to the estuaries of the Roche, Crouch, Blackwater, and Colne; to Walton Creek, the Stour, the Deben, and the Alde, on to Lowestoft. The depth in the estuaries at low water, where studied, was generally from $1\frac{1}{2}$ to 4 fathoms. The open water most frequently examined was that of the Swin and Wallet, from which the above-named estuaries more or less directly branch. The average depth of this more open water was about 6 fathoms at low tide. Very many determinations have been made of the density of the water, but I think it undesirable to publish the detail until the results are more complete. It may, however, be said that occasionally in the summer months the water in some of these estuaries, many miles from the sea, is considerably more salt than in the Swin or Wallet, and still more so than in the North Sea, no doubt on account of the relatively great evaporation in shallow water. When this is the case, we have the anomalous result, that the low water is more salt than the high, which is the reverse of the usual character.

My observations have invariably commenced and ended in the estuary of the Colne, but the intermediate period has been spent in some of the various estuaries already named, without any definite order. This migratory system has, of course, disadvantages as well as advantages. I am unable to give the monthly variation for any particular locality; but at the same time I have been able in many cases to compare the temperature of different districts at nearly the same time, by carefully observing that of the water in sailing from one port to another. It has also enabled me to compare the temperature of the estuaries and of the more open water.

In discussing the observations I commenced by grouping them according to stations, but soon saw that it would be more instructive to group them according to fortnightly or monthly periods, keeping the estuaries quite separate from the more open sea. The fortnightly periods seemed, however, to be too much influenced by what may be regarded as accidental circumstances, and I therefore give the mean results for the months of May, June, July, August, and September, before and after which period the weather is not satisfactory for living on a yacht in exposed places.

In calculating out the means it seemed desirable to give greater weight to results derived from more numerous determinations, and at the same time not to let the large number in one case too much overweigh those in another. I have therefore generally adopted the half-way between the results deduced by the two extreme methods as being the most trustworthy under the circumstances. For the temperature of the air I have adopted the means determined from the observations on deck at high water and low water. Since, on the long run, the time varied from early morning to late in the evening, the average would fairly well represent the temperature of the air over the water, which, no doubt, often varied much from that over the land.

The following tables give the mean temperature of the surface and bottom water at high tide and at low tide, and of the air on deck, without any attempt to distinguish between spring tides and neaps, for which the data are not sufficiently complete:—

		High.	Low.	Air.
1884.	May, . .	57·92	58·48	56·77
	June, . .	61·69	62·39	65·47
	July, . .	65·55	66·94	68·52
	August, .	67·67	67·47	65·93
	September, .	63·20	62·70	63·12
1885.	May, . .	52·26	53·06	53·03
	June, . .	62·81	64·25	62·29
	July, . .	66·78	66·85	63·74
	August, .	62·51	62·47	63·11
	September, .	59·12	59·17	60·60
1886.	May, . .	54·62	56·99	60·16
	June, . .	58·97	59·27	57·42
	September, .	64·87	63·51	61·81
1887.	May, . .	49·75	52·02	54·91
	July, . .	69·38	69·67	67·15
	September, .	58·74	57·53	56·94
1888.	May, . .	55·12	54·33	52·96
	June, . .	59·63	59·24	61·74
	July, . .	59·38	60·83	60·87
	August, .	61·06	62·24	64·37
	September, .	59·92	60·37	60·00

The means for the three complete seasons 1884, 1885, and 1888, are:—

	High.	Low.	Air.
May, . .	55·10	55·46	54·25
June, . .	61·38	61·96	63·17
July, . .	63·90	63·87	63·28
August, .	63·75	64·06	64·47
September, .	60·75	60·75	61·23

Including the incomplete years, and making allowance for the number of observations, the means are :—

	High.	Low.	Air.
May, . .	54·18	55·48	55·39
June, . .	60·77	61·48	60·14
July, . .	65·67	66·44	65·07
August, .	64·03	64·25	64·28
September, .	61·00	60·56	60·51
Means, .	61·13	61·64	61·08

In the corresponding period the average temperatures in the more open water of the Swin and the Wallet were :—

May.	51°80	August, . . .	63°36
June, ...	60·24	September, . .	61·30
July, ...	64·18		

Compared with these numbers the temperatures in the estuaries were as follows :—

	High.	Low.		High.	Low.
May, .	+2°38	+3·68	August, .	+·67	+·89
June, .	+ ·53	+1·24	September, .	−·30	−·74
July, .	+1·49	+2·26			

In July 1886 the North Sea was above 2°·33 cooler than the Wallet, and 5°·55 cooler than the estuaries.

These results are also confirmed by a comparison of the temperatures in the estuaries and more open water on the same days, the excess in the estuaries being:—

May, ...	3°61	August, ...	·50
July, ...	3·22	September, . . .	·50

The explanation of all these facts is of course very simple, for they clearly show that the increasing heat in spring rapidly increases the temperature of the comparatively small bulk of water in the shallow estuaries, before it has had much effort on the greater bulk of water in the more open sea, and their smaller bulk causes them to be more rapidly cooled in autumn. The difference between the temperature of high and low water completely agrees with this; and the facts seem to me to explain why in the earlier part of the season the number of minute free-swimming animals in the estuaries is so much greater than in the open sea, whereas in September this relation is reversed.

The observed maximum temperatures of the water in the estuaries and of the air were as follows :—

	Water.	Air.
1884.	72°1. Aug. 12	76°6. July 4
1885.	74·1. July 11	78·1. June 4
1886.	72·2. July 6	75·5. July 5
1887.	73·5. July 26	81·0. Aug. 8
1888.	65·4. Aug. 10	81·0. June 3
Means.	71·4. July 25	78·5. June 29

Hence the average maximum for the water was 7°·1 less than that of the air, and occurred about twenty-six days later.

I have paid much attention to the difference between the temperatures in the estuaries near the surface and near the bottom. In very extreme cases, when the tide had risen over a wide expanse of mud, heated by the sun, the surface temperature has been found as much as 2° above that of

the bottom. When the hot sun is shining on the water a difference of 1° may be observed, but the run of the tide in estuaries only 5 or 6 fathoms deep and less so mixes the water that a difference of ½° is much more usual. When the air is much cooler than the water the surface is occasionally found ½° or more cooler than the bottom; but this is usually after rain, when the surface water is somewhat less salt, so that a slightly lower temperature does not make it denser than the bottom water. On the long run there is undoubtedly an excess of temperature at the surface, which is easily understood when we bear in mind that the warmer water floats on the surface and the cooler sinks down into the deeper channels, and tends to go out to sea. This perhaps explains why the mean temperature of the high water very closely corresponds to that of the air, whereas that of the low water is decidedly in excess.

Dividing my observations into three groups, viz., the early, the middle, and the late parts of the season, I obtain the following amounts of excess of temperature on the surface:—

	High.	Low.	Mean.
May and June, ...	·353	·153	·253
July and early August, . .	·169	·197	·183
Late August and September,	·029	·072	·050

The greater difference at high water is no doubt because the water is then so much deeper, and cool water comes in at the bottom from the outside. On the whole, the results are what might have been expected, since the difference is greatest when the temperature is rapidly increasing. The difference being so small clearly shows how completely the water is mixed by the tidal current in the central part of an estuary. For more sheltered places the difference is probably often much greater.

On comparing together the results obtained for each separate year, it is easy to see that each has special characters which are well brought out by graphic representation. On the whole, it may be best to consider merely the temperature of the high and low water. The mean result for the five years is that, following atmospheric variations with smaller irregularities, both increase from May to a maximum in July, and then decrease to September; but in an anomalous cold year, like 1888, there was no maximum in July, and only a very small one in August. As a general rule, as named above, the low water is warmer than the high early in the season, and cooler at the end; but in particular years these relations are more or less changed, as shown in the following table, which gives the excess of the temperature of low water or its deficiency by the + or − sign.

	May.	June.	July.	August.	September.
1884, .	+ ·56	+ ·70	+1·39	− ·20	− ·50
1885, .	+ ·80	+1·44	+ ·07	− ·04	+ ·05
1886, .	+2·37	+ ·30	...	...	−1·36
1887, .	+2·27	...	+ ·29	...	−1·21
1888, .	− ·79	− ·39	+1·45	+1·18	+ ·45
Means, .	+1·04	+ ·51	+ ·80	+ ·31	− ·51

These differences may appear small, but they represent most important influences which produce great changes in marine life, as those dependent on oyster culture often learn to their cost.

Up to the present time my observations this year (1889) have been much more complete than in any former, and I hope to carry out the same system to the end. It, however, does not seem desirable to discuss merely one portion.

A comparison of the temperatures at high or low water, morning and evening, or evening and the next morning, enabled me to learn the effect for each month of the heat of the day or the cold of the night on the water of the estuary itself, or on that coming in from the outside with the rising tide. My observations are fairly complete, being somewhat doubtful only in one item, viz., the effect of night on high water in August; but to enable me to properly utilise the rest, this has been assumed to be equal to the average. The following table gives the differences, + for day and − for night:—

High Water.	May.	June.	July.	Aug.	Sept.
Day, . . .	+1·56	·54	2·16	·50	·60
Night, . . .	−1·18	·55	·59	·76	·71
Low Water.					
Day, . . .	+ ·93	2·95	2·50	1·50	·68
Night, . . .	−1·01	2·00	2·41	1·50	·60
Mean for day, . .	+1·24	1·74	2·33	1·00	·64
„ night, .	−1·09	1·27	1·50	1·10	·65

Neglecting the difference of sign we find the changes of temperature to be as follows:—

	May.	June.	July.	Aug.	Sept.
Mean effect on high water, .	1·37	·54	1·37	·63	·65
„ low water, .	·97	2·47	2·45	1·50	·64
Means, . .	1·17	1·50	1·91	1·06	·64

These last means clearly show that the amount of change due to the heat of the day and the cold of the night increases to a maximum in July, and then decreases.

A comparison of the general means for the whole five months shows some interesting facts:—

Mean effect of heat of day on high water, . .	1·07
„ „ low water, . .	1·71
Mean effect of cold of night on high water, . .	0·76
„ „ low water, . .	1·50
General mean effect of day, ...	1·39
„ „ night, ...	1·12

These can be looked upon merely as approximations; but, as far as

they go, they clearly show that (as might have been expected) the effects are greater on the small bulk of water in the estuaries than on the greater bulk out at sea. They also show that during the period from May to September inclusive, the general effect of the heat of the day is greater than that of the cold of night, which of course agrees with the permanent rise of temperature during that period.

Estuaries differ from the more open sea in many very important particulars besides temperature; but, at the same time, it appears to me that the facts I have described suffice to explain some characteristic peculiarities in the local distribution of marine animals and plants which cannot be explained by the variation in the amount of salts in solution, or by difference in exposure to the action of the waves.

ON THE ACHIEVEMENTS OF SCOTSMEN DURING THE NINETEENTH CENTURY IN THE FIELDS OF GEOGRAPHICAL EXPLORATION AND RESEARCH.

A REPORT TO THE PARIS GEOGRAPHICAL INTERNATIONAL CONGRESS OF 1889.

By Arthur Silva White, F.R.S.E.,

Secretary to the Royal Scottish Geographical Society.

(*Conclusion.*)

EUROPE AND GENERAL.

Having briefly reviewed, under convenient geographical divisions, the achievements of Scotsmen in the various parts of the world, excepting Europe, I shall conclude by grouping under the above heading what remains to be chronicled. In the brief time allowed for the preparation of this Report, it is not in my power to notice adequately the leading contributions of Scotsmen to the progress that has been made during the present century in our geographical knowledge of the British Isles, or of the Empire as a whole; far less am I able to enter on the fruitful field of geographical progress in Europe or into the various departments of literary research. In some respects it is almost impossible to separate the work of Scotsmen from that of others in the same fields, or, even, to eliminate their work at home from their work relating to foreign countries. Within more restricted limits, therefore, I shall endeavour to record some of the most notable geographical achievements of Scotsmen in Europe, especially in Scotland, which may most conveniently be grouped under the one general heading.

One of the first names that occurs to one is that of Sir Roderick Murchison (1792-1871), whose eminence as a geologist was world-wide, and whose interest in geography, especially in the latter part of his career, was fruitful in good results. He wrote his first geological

paper in 1825, and more than one hundred papers afterwards. His travels were extensive; he personally examined the geology of not only every district in Great Britain, but of almost every country in Europe, and of some parts of Asia. His most important works are *The Silurian System* (1839); *The Geology of Russia and the Ural Mountains* (1845); and *Siluria* (1854). He defined the Silurian System and the Permian System, and established the fact of a graduated transition from secondary to tertiary rocks in the south-east Alps, etc.; he was the first to recognise that the gneissic rocks of the north-west Highlands of Scotland are the oldest in Britain; and he inferred the presence of auriferous deposits in Australia long before their discovery by Count Strzelecki was announced. Murchison was pre-eminent for the skill with which he could read the geological structure of a country. He also paid great attention to Australian geography, but his name is chiefly associated with Arctic and African discovery, in the cause of which he rendered many valuable services. He was mainly instrumental in founding, in 1830, the Royal Geographical Society of London; his anniversary addresses and loyal labours as President of that body were of a highly important character. He, moreover, founded the Chair of Geology in the University of Edinburgh. JOHN PLAYFAIR (1748-1819) was a disciple of Dr. James Hutton,[1] author of the celebrated *Theory of the Earth*, which may be said to have laid the foundation of the modern system of Physical Geology. Playfair's well-known *Illustrations of the Huttonian Theory* (1822) not only gave a great impetus to the pursuit of physical geology, but is still studied and cited as a standard authority on denudation and the origin of the surface-features of the land. He was the first to discuss the glacial origin of the large erratics from the Alps which are scattered over the Jura, and thus anticipated the later generalisations of Charpentier and Agassiz. One of Playfair's associates was SIR JAMES HALL (1761-1832), who aided in the promulgation of Hutton's views as to denudation and earth-sculpture, but who is best known as the founder of Experimental Geology, in which branch of inquiry MM. Delesse and Daubrée are now the greatest authorities. In 1826 DR. JOHN MACCULLOCH (1773-1835) was commissioned by Government to prepare a geological map of Scotland, which was not published till after his death. This map was the first that had any pretensions to general accuracy, and, as the work of one man, is a notable production. In his *Description of the Western Islands of Scotland* (1819) he sketched very clearly the general physical features of regions which at that time were imperfectly known. SIR CHARLES LYELL (1797-1875) was the author of many papers and works on various branches of geology; but I mention only his great *Principles of Geology* (1830), the leading ideas of which had already been promulgated by Hutton and Playfair. Lyell, however, may be said to have popularised them for the first time, and the publication of his *Principles of Geology* doubtless marks an epoch in the progress of the science. DR. HUGH FALCONER (1808-1865) deserves mention, as well for his many contri-

[1] Hutton was also a Scotsman, but his decease in 1797 places him outside the limits of this Report.

butions to our knowledge of the flora of India, to which I have already referred, as for his palæontological discoveries and researches in that country and in Europe. Principal JAMES DAVID FORBES (1809-1868) the well-known physicist, contributed also largely to physical geology, his researches on glaciers and glacial motion being well known. He seems to have been the first to recognise and depict upon a map the true plateau-character of the Scandinavian uplands. Professor JAMES NICOL likewise deserves mention, as being the author of the first general *Guide to the Geology of Scotland* (1844). SIR ANDREW CROMBIE RAMSAY, late Director-General of the Geological Survey of Great Britain and Ireland, is the author of numerous works dealing principally with physical geology. He is an advanced supporter of the views advocated by Hutton and Playfair as to the sculpturing of the earth's surface by epigene agents of change, and it is owing largely to his influence that these views are so generally adopted by geologists. One of his most remarkable papers is that which attributes the origin of many rock-basins—such as the lake-basins of the Alps, Scotland, etc.—to glacial erosion. His most popular work is the *Physical Geology and Geography of Great Britain* (1863). The geological publications of HUGH MILLER were many and valuable. His brilliant powers of description, as exemplified in his treatise on the *Old Red Sandstone*, and in other works, went far to bring Geology into prominence in Scotland, and to popularise its study as a science. The DUKE OF ARGYLL has devoted much attention to the Geology of Scotland. From his observations he has been led to differ from other authorities as to the origin of the scenery of Scotland, and maintains his theory of the Geological Geography of Scotland by reference to the configuration of the Western Highlands. CHARLES MACLAREN, the journalist, known chiefly from the fact of his having written an account of the geology of Fife and the Lothians (1838), wrote one of the best accounts of the site of Troy in the *Plain of Troy Described* (1863).

Of writers who in the first half of the century did much to elucidate the geology of their native land—many of them having contributed elaborate monographs on special districts of Scotland—mention may be made of the following:—THOMAS ALLAN, the author of many papers treating of the geognosy of Scotland, described the rocks of the Faröe Islands. GEORGE ANDERSON was the author of papers on the descriptive geology of various parts of Scotland. The REV. JOHN ANDERSON, palæontologist and geologist, confined his labours chiefly to Scotland. ROBERT BALD, physicist and geologist, was the author of admirable accounts of the Scottish coal-fields. DR. GEORGE BUIST, physicist, geologist, and geographer, the author of many papers dealing with the geology and physical geography of India, Egypt, the Red Sea, etc., wrote an excellent essay on the geology of a part of Perthshire. PETER CHALMERS was the author of an account of the coal-fields of Dunfermline. ROBERT CHAMBERS, author of the well-known *Vestiges of Creation*, wrote much also on the geology of the superficial formations of Scotland, Norway, Faröe Islands, etc. JOHN CRAIG, geologist, described some of the coal-bearing tracts of Western Scotland. R. J. HAY CUNNINGHAM

was the author of several admirable monographs on the physical geology of various counties of Scotland. The Rev. J. Fleming, naturalist, the author of works on zoology and botany, wrote many papers dealing with the descriptive geology of Scotland. Lord Greenock also wrote some papers on descriptive geology. Samuel Hibbert, who contributed papers on physical geology and palæontology, was the author of a work on the Shetland Islands, and of a *History of the Extinct Volcanoes of the Lower Rhine*, etc. J. Imrie wrote papers on the geology of Scotland, and on the geology of Gibraltar. Professor Robert Jameson, the author of papers and general treatises dealing with mineralogy and zoology, wrote also numerous papers on the geognosy of various parts of Scotland. David Landale was the author of various reports on the Scottish coal-fields. Sir G. Stewart Mackenzie was the author of a work on Iceland, and papers on the geology of the Faröe Islands, the physical geology of some districts of Scotland, and other subjects. Thomas Macknight wrote papers on the petrology and physical geology of various districts in Scotland. John Martin was the author of a good description of the geology of Morayshire. David Milne-Home has written papers on descriptive geology, amongst which his account of the coal-fields of Mid-Lothian and East-Lothian is the most important. He was instrumental in getting complete reports of the distribution of erratic boulders in Scotland. William Montgomery was the author of an account of the geology of Renfrewshire and North Ayrshire. William Rhind was the author of a geological map of Scotland, and a general treatise on geology. William Stevenson wrote papers on the geology of the south-east of Scotland. All the preceding began to write early in the century, and only one or two survive.

Of authors who have dealt with descriptive geology in the latter half of the century, it is hardly necessary to give a list. The work of most has been strictly specialised, and seldom travels beyond the limits of geological science and physical geography. Indeed, so large a part of Scotland has been mapped by the Government Ordnance and Geological Surveys that observers now restrict themselves very much to the study of local details. Of those who have been engaged on the Geological Survey of Scotland, most have been Scotsmen, and some of them have obtained a world-wide reputation. By far the best known are the first two names I have to mention. Dr. Archibald Geikie, who succeeded Sir A. C. Ramsay as Director-General of the Geological Surveys of the United Kingdom, is esteemed not only as a diligent worker in geology, but also as a writer on geographical subjects. His most important geological papers are those dealing with the volcanic and Palæozoic rocks of his native land. An earnest disciple of Hutton and Playfair, he has also largely contributed to our knowledge of the origin of the surface-features of the land, his views being set forth particularly in his charming work on the *Scenery and Geology of Scotland* (1865 and 1889). They are likewise treated of in his elaborate *Text-book of Geology* (1882), and in many papers and essays in various journals and reviews. He is editor of a new series of geographical works which are now being issued by Messrs. Macmillan—a series to which he contributed a general introductory volume

and a short *Geography of the British Isles*. His brother, Professor James Geikie is known as an enthusiastic and eminent geologist, and a sound geographer, and has taken pains to point out the bearing of geology on geographical science—a bearing which, although fully recognised abroad, is almost ignored in this country. On this subject he has contributed several valuable papers to the *Scottish Geographical Magazine*, of which he is the Honorary Editor. In addition to the maps and memoirs prepared by him for the Geological Survey, he has written many papers on physical and descriptive geology, the more important of which treat of Palæozoic and glacial geology. His chief works are the *Great Ice Age and its relation to the Antiquity of Man* (1873; 1877)—a work in which he was the first to maintain that Palæolithic man was of glacial and interglacial age, and did not reappear in Europe after glacial conditions had passed away: and *Prehistoric Europe* (1881), which gives a somewhat detailed sketch of the geographical and climatic changes[1] that characterised our continent in Pleistocene, Postglacial, and recent times.

Other Scottish members of the Geological Survey who may be specially mentioned are Messrs. Benjamin N. Peach and J. Horne, who have written in conjunction some admirable papers on descriptive geology, and who have likewise been united in working out the geological structure of the north-west Highlands,—perhaps one of the most complicated regions in the world, and the final unravelling of which forms an epoch in the geological investigation of our Islands. Another prominent name in connection with the same Survey is that of James Croll, author of *Climate and Time* (1875), *Climate and Cosmology* (1885), *Stellar Evolution* (1889), etc., and many papers dealing with physics and physical geology. His views on the changes of climate, of which geology affords so much evidence, are so well known that I need only refer to them here. Mr. H. M. Cadell has recently thrown some light on the origin of mountains by his experiments on the crumpling of strata of dissimilar rocks. It would be impossible to cite the names of all Scottish geologists who have enriched science with their contributions during the latter half of the century; but I must not omit to mention Professor Lapworth, whose labours among the older rocks of Scotland have been most important. He shares with Messrs. Peach and Horne the credit of unravelling the complicated structure of the north-west Highlands.

Of Scottish physicists and chemists,[2] the following may be mentioned in connection with the subject of this Report. Sir John Leslie (1766-1832) was distinguished for his investigation of the Principles of Radiant Heat, the results of which were published in his *Experimental Inquiry into the Nature of Heat*. He was the inventor of the differential thermometer, a hygrometer, etc., and author of the famous experiment of freezing water

[1] See also "The Geographical Evolution of Europe," *Scot. Geog. Mag.*, vol. ii. p. 193, *et seq.*

[2] I am indebted for some of the records of Scottish physicists and naturalists to *Viri Illustres*, the useful little handbook published at the time of the Tercentenary Meeting of the University of Edinburgh.

by the cold resulting from its own evaporation. Sir David Brewster (1781-1868), whose experimental researches in physical optics were so important in their results to science, made some inventions, and numerous improvements, in optical apparatus. James Clerk Maxwell (1831-1879) was distinguished for his mathematical treatment of physical problems. He contributed several valuable memoirs, and greater works on Heat, Electricity, and Magnetism. His work on *Electricity and Magnetism* (1873) is said to be "one of the most splendid monuments ever raised by the genius of a single individual." His *Theory of Heat* was published in 1871, and *Matter and Motion* in 1877. Professor P. G. Tait, equally eminent as a physicist and author of numerous treatises and text-books on mathematical and physical subjects, has made a thorough investigation of the influence of pressure at great depths in the sea on the density of sea-water and on the readings of thermometers. He is the joint author with Dr. Buchan of the comprehensive Report, elsewhere alluded to, on Oceanic Circulation, which is shortly to be published in the *Challenger Reports*.

Of Scottish naturalists, whose contributions to geography were considerable, the name of Robert Brown (1773-1858), whom Humboldt designated *facile princeps botanicorum*, already occurs under "Australasia." Edward Forbes (1815-1854) investigated the fauna and flora of Algiers, Styria, the Ægean Sea, Lycea, and other regions visited by him, and was the first to investigate systematically the bathymetrical range of marine organisms, being one of the earliest students of distribution. Henry Goodsir had made discoveries of some importance on Franklin's ill-fated expedition before perishing with his gallant leader. Sir Charles Wyville Thomson (1830-1882) was specially identified with that series of investigations of the fauna of the deep sea which culminated in the voyage of the *Challenger* (1872-76), of which expedition he was Scientific Director. He discovered many new forms of animal life during this and previous expeditions. His *Depths of the Sea* (1873) contains an account of the cruises of the *Lightning* and the *Porcupine*. He was engaged up till his death in editing the *Scientific Results* of the voyage of the *Challenger*, to which he was also a literary contributor. Dr. John Murray accompanied as naturalist H.M.S. *Challenger* on her famous scientific expedition, during which he closely studied the physical conditions of the oceans and their deposits. He specially directed his attention to coral reefs, and the result of his observations led him to believe that Darwin's theory of subsidence could not sufficiently account for all the phenomena presented in connection with those vast concretions. On the return home of the *Challenger*, Dr. Murray continued on the staff, and on the death of Sir Wyville Thomson was appointed Director of the Commission. His theory regarding the origin and structure of coral reefs was formulated in a paper read before the Royal Society of Edinburgh (Session 1879-80), but it did not at first command the attention it deserved. More recently, however, it has been supported by a mass of evidence from independent observers, and has been adopted by a large number of geologists and physicists. To Dr. Murray is mainly due the great and increasing interest taken in the science of

oceanography; and his forthcoming report on the deep-sea deposits collected by the *Challenger* and other surveying vessels will be of the highest interest. The important papers published by him in the *Scottish Geographical Magazine*[1] have commanded universal attention. He established and equipped the Scottish Marine Station at Granton, with a branch on the Clyde, for scientific research, his own work in connection with which has resulted in several discoveries relating to the geographical distribution of marine animals; and he took a leading part in the foundation of Ben Nevis Observatory. He was the first to determine the true properties of *Bathybius*. MR. J. A. HARVIE-BROWN was, together with Mr. John Cordeaux, the first to institute systematic investigations into the migratory movements of birds as observed on the British coasts. This work was afterwards taken up by the British Association; nine Annual Reports were issued, to which Mr. Harvie-Brown contributed the statistics for the Scottish coasts. He is, however, best known for his work in connection with the detailed and systematic investigation of the vertebrate fauna of Scotland, to which he has latterly devoted himself. In collaboration with Mr. Buckley, he has published *The Vertebrate Fauna of Sutherland, Caithness and Cromarty* (1887), *The Vertebrate Fauna of the Outer Hebrides* (1889), Papers in *The Ibis* on the European avifauna, and a volume on the *Capercaillie in Scotland*, wherein the old records of the bird, both as an indigenous species, and as an introduction, after its extinction, are exhaustively treated. PROFESSOR COSSAR EWART, in connection with the Fishery Board of Scotland, has done much to elucidate the distribution of marine animals, especially of food-fishes. W. MACGILLIVRAY (*d.* 1852) was the author of *History of British Birds* (1836); GEORGE JOHNSTONE (*d.* 1855) wrote a *History of British Zoophytes* (1838); SIR WILLIAM JARDINE (*d.* 1874), the ornithologist, was the editor of *Naturalist's Library*; HEWETT COTRELL WATSON was a geographical botanist of merit.

Of Scottish meteorologists, the name of DR. ALEXANDER BUCHAN, whom the Americans style "the father of Meteorology," stands out in remarkable and deserving prominence. Dr. Buchan's work comprises very many important contributions to the meteorology of Scotland from 1860 down to the present time, and very many valuable original contributions to general meteorology. Among the latter may be mentioned the construction for the first time of maps of the isobarics and prevailing winds of the globe; rainfall of the British Isles; the weather and health of London; the horary range of the barometer over the globe; the discussion of the meteorological observations on board H.M.S. *Challenger*, in which he was assisted by MR. H. N. DICKSON, and which includes a revision of the isobars and prevailing winds

[1] *Drainage Areas of the Continents, and their Relation to Oceanic Deposits* (vol. ii.); *The Exploration of the Antarctic Regions* (vol. ii.); *On some recent deep-sea Observations in the Indian Ocean* (vol. iii.); *On the total Annual Rainfall on the Land of the Globe, and the Relation of Rainfall to the Discharge of Rivers* (vol. iii.); *On the Height of the Land and Depth of the Ocean* (vol. iv.); *On the Effects of Winds on the Distribution of Temperature in the Seas and Fresh-water Lochs of the West Coast of Scotland* (vol. iv.); and *On Marine Deposits in the Indian, Southern, and Antarctic Oceans* (vol. v.).

of the globe up to date; new isothermals for the globe for each month: and many other important contributions to meteorology. His *Handy Book of Meteorology* (1867) is a standard work. The important article *Meteorology* which he contributed to the *Encyclopædia Britannica* is worthy of special mention. Of other notable contributions to meteorology by Scotsmen the following may be mentioned:—(1) on the mean temperatures of the globe and mean hourly temperatures at Leith, Inverness and Kingussie; isothermals of the north-west of America; and polarisation of the atmosphere, by Sir David Brewster; (2) report on progress of meteorology, climate of Edinburgh, temperatures of hot springs, earth-temperatures at Edinburgh, the climate of Palestine, etc., by Principal J. D. Forbes; (3) on the barometric gradient by Mr. Thomas Stevenson; (4) on weather and health, Scottish prognostics, and ozone observations, by Sir Arthur Mitchell; and on weather and clouds, by Mr. Ralph Abercromby. The self-denying perseverance of Mr. R. T. Omond in personally superintending the Meteorological Observations of the Ben Nevis Observatory, the only high-level station in the British Isles, has resulted in some noteworthy additions to our knowledge of the higher regions of the atmosphere.

Of Scottish geographers and cartographers, the most eminent has been Dr. Keith Johnston (1804-1872). He merits the distinction of having done more than any previous writer to popularise the study of Geography; and he practically introduced the study of physical geography. His masterpiece was *The Physical Atlas of Natural Phenomena* (1848), which for so long was the basis of the whole English literature on this subject. His first large work was the *National Atlas*, the best at its time; his *Dictionary of Geography* (1850) was an original work; and his *Royal Atlas of Modern Geography* (1861), commenced in 1855, is still (1889) the best British Atlas published. Some of his other publications I have noted elsewhere. Mr. John Bartholomew is also well known as one of the most active cartographers of the present time. In addition to the preparation of numerous atlases and miscellaneous maps, he has done much towards the improvement of topographical maps, by introducing orographical contour colouring. I understand it can be shown by statistics that Edinburgh produces more maps than any other city in the world, the firms of Messrs. Johnston and Bartholomew being the largest map-producers of the present time.

The work of other Scotsmen, among the many whose pursuits or whose interests have led to notable contributions to the geographical progress of the century, may be briefly, though imperfectly, recorded here. Sir Robert Christison made contributions to the subject of the determination of the different chemical qualities of our lakes and rivers. Sir James Clark Ross, whose achievements have been noted elsewhere, was employed by the Admiralty (about 1836) in the Magnetic Survey of Great Britain and Ireland. The Earl of Crawford and Balcarres is a distinguished astronomer; his work in the Transit of Venus Expedition (1878) was important; he recently presented to the city of Edinburgh the instruments of his observatory at Dunecht, one of the most thoroughly equipped of private observatories, and known extensively

from the Dunecht circulars of comets. Mr. J. Y. Buchanan, chemist and physicist to the *Challenger* Expedition, has made interesting investigations in Ocean Circulation. His subsequent researches on the nature of the slope separating continents and oceans brought many new facts to light regarding the existence of submarine mountains and river cañons. Dr. Hugh Robert Mill, whose temperature and other observations on Scottish rivers and lakes have been of value, has more recently become an exponent of Commercial Geography. Mr. Hugh A. Webster has contributed important geographical articles to the last edition of the *Encyclopædia Britannica*, and was for some time the Honorary Editor of the *Scottish Geographical Magazine*.

The Royal Scottish Geographical Society was founded in Edinburgh in 1884 through the initiative of Mr. J. G. Bartholomew, Mr. and Mrs. A. L. Bruce and Mr. Hugh A. Webster. With branches in Glasgow, Dundee, and Aberdeen, and a membership (July 1889), numbering 1165, it is the national Geographical Society of Scotland. A new force has thus been introduced into Scotland for the public discussion of geographical questions, and for the promotion of geographical education, exploration and research. Through the medium of its journal, the *Scottish Geographical Magazine*, published monthly, the Society has consistently endeavoured to treat, from the geographical standpoint, some of the international questions of the day; but its special functions have been to deal with the scientific application of geography, in its practical as well as technical aspects, to popularise its study, and to provide a more or less comprehensive record of geographical progress. What little the Society has as yet been able to do for the promotion of geographical exploration, is recorded elsewhere in this report; its Education Scheme, though modest, has already been productive of good results.

BIBLIOGRAPHY: EUROPE AND GENERAL.

In the foregoing, I have already referred to, and sufficiently commented on, the following works:—Sir Roderick Murchison's *The Silurian System* (1839), *The Geology of Russia and the Ural Mountains* (1845), and *Siluria* (1854); John Playfair's *Illustrations of the Huttonian Theory* (1822); Dr. MacCulloch's *Description of the Western Islands of Scotland* (1819); Sir Charles Lyell's *Principles of Geology* (1830); James Nicol's *Guide to the Geology of Scotland* (1844); Sir Andrew Ramsay's *Physical Geology and Geography of Great Britain* (1863); Hugh Miller's *Old Red Sandstone*; Charles Maclaren's *Plain of Troy described* (1863); Robert Chambers's *Vestiges of Creation*; Samuel Hibbert's *History of the Extinct Volcanoes of the Lower Rhine*; Dr. Archibald Geikie's *Scenery and Geology of Scotland* (1865), *Text-book of Geology* (1882), *Geography of the British Isles* (1889), etc.; Professor James Geikie's *Great Ice Age and its Relation to the Antiquity of Man* (1873), and *Prehistoric Europe* (1881); James Croll's *Climate and Time* (1875), *Climate and Cosmology* (1885), and *Stellar Evolution* (1889); Sir John Leslie's *Experimental Inquiry into the Nature of Heat*; James Clerk Maxwell's *Electricity and Magnetism* (1873), *Theory of Heat*

(1871), and *Matter and Motion* (1877); Sir C. Wyville Thomson's *Depths of the Sea* (1873); Harvie-Brown's *Vertebrate Fauna of Sutherland, Caithness, and Cromarty* (1887), *Vertebrate Fauna of the Outer Hebrides* (1889), and *Capercaillie in Scotland*; Magillivray's *History of British Birds* (1836); George Johnstone's *History of British Zoophytes* (1838); Sir William Jardine's *Naturalist's Library*; Dr. Buchan's *Handy Book of Meteorology* (1867); Keith Johnston's *Physical Atlas* (1848), *National Atlas, Dictionary of Geography* (1850), and *Royal Atlas* (1861).

To attempt anything like a comprehensive bibliography under this section of my Report would be out of the question; but the following additions may be made :—

The old *Statistical Account of Scotland* (21 vols.; 1791-9), which was first planned and subsequently edited by Sir John Sinclair from the accounts by the ministers of the respective parishes, saw a new edition in 1845 (15 vols.), which fell short of the excellence of its original. A short but good *Geographical and Statistical Description of Scotland* (1819) was published by James Playfair. John R. MacCulloch was the author of a standard work entitled *A Statistical Account of the British Empire*, which went through four editions between 1837 and 1854. The *Physical Geology and Geography of Great Britain*, by A. C. Ramsay, another successful work, went through five editions between 1863 and 1878. Mrs. Mary Somerville wrote the first scientific Physical Geography in the English language. Of archæological works, *The Archæology and Prehistoric Annals of Scotland* (1851) by Daniel Wilson, *The Early Races of Scotland and their Monuments* (1866) by Forbes Leslie, and *Arthurian Localities* (1869), with a map of Arthurian Scotland, by J. S. S. Glennie, are all books of geographical interest and importance. The *Beauties of Scotland* (1805-8) by Robert Forsyth, *Caledonia* (1807-24) by G. Chalmers, *The Pictures of Scotland* (1827) by Robert Chambers, are works of value to the geographer. Notes on, and lists of, the *Fauna and Flora of the West of Scotland*, and notices of some of the principal manufactures of the same district, were published in Glasgow for the 1876 Meeting of the British Association. Mr. George G. Chisholm has published, besides his geographical text-books, *The Two Hemispheres* (1881), which was enlarged and republished under the title *The World as it is* (1883-4). Mr. J. Scott Keltie, the editor of *The Statesman's Year-Book*, carried out an extensive inquiry for the Royal Geographical Society of London into the teaching of geography, upon which he reported, and which led to important results.

The Book of British Topography (1881), by J. P. Anderson, a classified catalogue of the topographical works in the British Museum, was the first attempt at a complete catalogue as regards Scotland; it contains all, I presume, of the county guides and books, to which no reference can be made here.

Some admirable gazetteers have been published in Scotland. The *Ordnance Gazetteer of Scotland* (1885), by Francis H. Groome, and the *Gazetteer of the British Isles* (1887), by John Bartholomew, the most recent publications, are quite the best of their kind. I may also mention

The Imperial Gazetteer of Scotland (1854-7), by Rev. J. M. Wilson; *The Gazetteer of England* (1836-37), by James Bell; *Chambers's Gazetteer of Scotland* (1832); and the *Imperial Gazetteer* (1855), by Dr. W. G. Blackie, who has also made other notable contributions to Geography, such as the *Imperial Atlas* (1855) and the *Comprehensive Atlas and Geography* (1880).

The standard encyclopædias, which are so valuable as books of geographical reference, are all of Scottish origin. The most famous, the *Encyclopædia Britannica*, was in the ninth and last edition edited by Professor Spencer Baynes and Dr. Robertson Smith. Then we have the more popular, but in its current edition equally useful, *Chambers's Encyclopædia*, edited by Mr. David Patrick. The *Encyclopædia Metropolitana*, first published in London, was subsequently obtained by a firm in Glasgow; the *Globe Encyclopædia* and the *Popular Encyclopædia* complete the list.

Some of the leading geographical text-books have been published by Scotsmen. Of these may be mentioned the works of Professors Archibald Geikie, Meiklejohn, and John Cleland; Drs. James Clyde, Alexander Stewart, A. Reid, A. Mackay, and Hugh R. Mill; and Messrs. Robert Anderson, Keith Johnston, junior; Thomas Ewing, and George G. Chisholm.

In conclusion, I cordially thank those of my correspondents who have been good enough to revise the proof-sheets of certain sections of this Report.

REPORT TO COUNCIL ON THE BRITISH ASSOCIATION MEETING AT NEWCASTLE, 1889.

By Hugh Robert Mill, D.Sc., F.R.S.E., *Delegate*.

The meeting of the British Association at Newcastle was successful so far, that many fairly popular papers were read in comfortable rooms, and the inhabitants were extremely hospitable. The attendance of members was not large, nor was much original scientific work communicated.

Signs of approaching change in the Association appeared in the unprecedented action of the General Committee refusing to ratify an appointment by the Council. The opportunity of reform thus presented is one which should not be allowed to pass without a reconsideration of the objects of the Association, and the means by which these can best be carried out at the present time. It is questionable whether science is perceptibly advanced by the annual meetings conducted as at present. The local literature evoked by the gathering was of the usual kind. The *Handbook of Industries* edited by Mr. Wigham Richardson is the best which has been compiled for the Association for many years. It comprises thirty articles by specialists describing the leading industries of Tyneside, with historical notes and statistics. A series of good agricultural, railway, and district maps completes an excellent epitome of the commercial geography of the Great Northern Coal Field of England.

At the conferences of delegates of corresponding societies there were no noteworthy incidents, the discussions being mainly on the rules affecting the position of delegates, few of whom were empowered to report any work done by their respective societies. It was matter of surprise and comment that the Tyneside Geographical Society took no part in the proceedings of the Association, the opportunity being one which, had it been seized, would undoubtedly have strengthened the position of that young but practical and deserving Society.

Mr. Silva White, Secretary of our Society, acted this year as one of the Secretaries of the Geographical Section, and by his position was enabled to secure many of the most valuable papers for the *Magazine*. It is therefore unnecessary for me to refer to the proceedings of the Section in detail. The address of Sir Francis de Winton as President was intended to strike a key-note of Commercial Geography, which it was hoped would give tone to the following papers and discussions. The result was disappointing. Except in one or two instances the papers which made any pretensions to the title of Commercial Geography contained very little Geography, and the discussion on several occasions became purely political, the addresses of some speakers being thoroughly inappropriate to a scientific meeting.

Explorers always attract the public, and this year they were well represented. Dr. Nansen as he recounted his adventures on the Greenland ice must have felt that his heroic journey had been fully appreciated. The simple manly style in which he told the now familiar story, and his quaint and unexpected gleams of humour, commanded the closest attention of a crowded and enthusiastic audience. Another Norwegian, Mr. Karl Lumholtz, was remarkably interesting in describing his travels among the aborigines of Queensland. Mr. Basil Thomson's original information regarding the islands near New Guinea, and Mr. Theodore Bent's descriptions of his archæological researches in the Bahrein Islands of the Persian Gulf were well worthy of the hearty reception accorded them. Sir Robert Biddulph's account of Cyprus, and the description of Uganda by the Rev. R. P. Ashe were also deservedly appreciated ; but the minute details of long topographical and commercial papers, such as that of Colonel Bell on the Russo-Chinese frontier region, and Mr. Gundry on China, somewhat wearied the audience, although they will prove of much value when published. Almost the only contribution to Physical Geography was Mr. Flinders Petrie's most interesting note on wind-action in Egypt. This paper ranks, along with Mr. Ravenstein's corrections on some recognised latitudes in the Nile valley, as an original communication of positive scientific value.

Following is a list of the office-bearers of Section E, and the papers read on the various days :

SECTION E.—GEOGRAPHY.

President.—Colonel Sir Francis de Winton, K.C.M.G., C.B., D.C.L.

Vice-Presidents.—General Sir H. E. L. Thuillier, R.A., C.S.I., F.R.S., F.R.G.S. ; R. Spence Watson, LL.D. ; J. Batalha-Reis.

Secretaries.—J. S. Keltie (*Recorder*) ; H. J. Mackinder, M.A. ; R. Sulivan ; A. Silva White, F.R.S.E.

Committee.—Theodore Bent ; C. E. D. Black ; Dr. Walter G. Blackie ; Sir

George Bowen, G.C.M.G. ; Sir T. Fowell Buxton, Bart. ; Paul B. Du Chaillu ; F. W. Dendy ; Francis Galton, F.R.S. : Chevalier R. Froehlich ; J. G. Gurney ; Lieutenant Kund ; Dr. H. R. Mill ; Dr. F. Nansen ; Sir Lambert Playfair, K.C.M.G. ; Admiral Sir Erasmus Ommanney, C.B., F.R.S. ; Dr. John Rae, F.R.S. ; E. G. Ravenstein ; H. Seebohm, F.L.S. ; Eli Sowerbutts ; Rev. Canon Tristram, D.D., F.R.S. ; Coutts Trotter.

Papers read on Thursday, September 12, 1889.

1. President's Address.
2. *Sir Robert Biddulph, G.C.M.G.*—Cyprus.
3. *Captain Thys.*—The Congo Railway.
4. *Dr. H. R. Mill.*—Physical Basis of Commercial Geography.
5. *Rev. R. P. Ashe.*—Uganda.
6. *His Excellency Governor Moloney.*—The Yoruba Country, West Africa.

Papers read on Friday, September 13, 1889.

7. *Colonel Mark S. Bell.*—The Russo-Chinese Frontier Region.
8. *R. Gundry.*—China.
9. *Hon G. Curzon, M.P.*—The Central Asia Railway in relation to the Commercial Rivalry of England and Russia.
10. *W. J. Flinders Petrie.*—Wind-Action in Egypt.
11. *Captain Hore.*—Lake Tanganyika.
12. *J. Batalha-Reis.*—Recent Portuguese Explorations in Africa.
13. *Captain Lugard.*—Nyassaland.
14. *J. Rankin.*—The Mouths of the Zambesi. (Read *in absentia.*)

Papers read on Monday, September 16, 1889.

15. *Karl Lumholtz.*—The Geography and Resources of Central Queensland.
16. *Alexander Cook.*—British North Borneo.
17. *H. Guillaume.*—Recent Explorations in Peru and Bolivia.
18. *E. G. Ravenstein.*—Geographical Co-ordinates in the Valley of the Upper Nile.
19. *R. Sulivan.*—The Resources of Siberia and the Practicability of the Northern Sea-route.
20. *Dr. Fridtjof Nansen.*—Greenland.

Papers read on Tuesday, September 17, 1889.

21. *Joseph Thomson.*—Report to the Committee appointed to investigate the Geography and Geology of the Atlas Ranges in the Empire of Morocco. (Read *in absentia.*)
22. *Basil Thomson.*—Exploration of New Guinea and Neighbouring Islands.
23. *Theodore Bent.*—The Bahrein Islands.
24. *Sir Lambert Playfair.*—The Jedars and other objects of interest in the District of Tiaret in Algeria.
25. *A. W. Clayden.*—Models to illustrate the Action of Winds on Ocean Currents.
26. *J. G. Colmer, C.M.G.*—The N.W. Territories of Canada.
27. *Dr. Guppy.*—Eastern Java. (Read *in absentia.*)

The exhibition of Dr. Nansen's famous *ski* and the sledge used in crossing Greenland, was appropriately combined with Mr. Riis Carstensen's beautiful paintings of typical Greenland scenery. Mr. A. W. Clayden exhibited instructive models, illustrating on a real water

surface the action of wind in promoting the formation and direction of the surface currents in the Atlantic and Indian Oceans. This model will, it was stated, shortly be made for sale as an aid in education.

Of papers read in other sections which were interesting geographically, the most important was Professor Osborne Reynolds' report on the investigation of estuaries by means of models, in which he describes further experiments with miniature tides in sorting out sand into banks and channels dependent on the form of the coast-line.

Dr. Sorby communicated to Section A a valuable series of temperature observations in the estuaries of the south-east of England. Professor Haddon, in the course of his recent visit to Torres Strait, collected some new information about the people as well as the marine animals of that locality, which he communicated to the proper sections. Amongst other facts of interest, he reports that no evidence of upheaval is to be seen in the coral islands of Torres Straits. The fauna and flora of many islands, and parts of continents, were described in Section D, while in C several valuable papers on geology were much akin to geography: Professor Milne and Professor Michie Smith on Earthquake Phenomena in Japan, and Mr. R. Swan on the Marble Quarries of the Isle of Paros, may be instanced as typical examples.

The Chemical Section rarely transacts business of geographical interest, but Professor Armstrong's report on the Teaching of Chemistry in Schools was really an extremely able scheme of scientific education in its widest form. It is gratifying to observe that he looks upon physical geography or earth-knowledge as pre-eminently the science for elementary schools, combining as it does great scope for instilling the scientific method of thought, and illustrations of every-day occurrences, the explanation of which is readily grasped and tenaciously remembered.

In consequence of the small attendance at the meeting, a less sum than usual fell to be allotted as grants in aid of research, and with the exception of those to Professor Osborne Reynolds to continue his experiments on estuaries, and to Mr. Bent for the further exploration of South-Western Asia, few of the grants affected subjects of geographical interest.

GEOGRAPHICAL NOTES.

EUROPE.

The Forests of Europe.—The *Deutsche Rundschau* (Bd. xi., Heft 12) gives the following table, extracted from the *Bulletin du Ministère des travaux publics* (Tome xvii., Jan. 1888) :—

Area of Forests.	Acres.	Percentage of total Surface.	Area of Forests.	Acres.	Percentage of total Surface.
Russia in Europe,	494,200,000	36·9	Roumania, . .	4,942,000	15·2
Sweden, . .	43,413,000	39·7	England, . .	3,116,000	4·0
Germany, . .	34,347,000	25·7	Servia, . .	2,394,000	19·9
Austria, . .	24,159,000	32·5	Greece, . .	2,100,000	13·1
France, . .	23,198,000	17·7	Switzerland, .	1,930,000	18·9
Hungary, . .	22,654,000	28·4	Belgium, . .	1,208,000	19·6
Spain, . .	20,964,000	17·0	Portugal, . .	1,164,000	5·3
Norway, . .	19,289,000	24·5	Holland, . .	568,000	7·0
Italy, . . .	9,034,000	12·3	Denmark, . .	469,000	4·8

The International Colonial Congress in Paris.—The Congress sat from July 30th to August 3, 1889, under the presidency of M. Barbey, ex-minister. Though entitled "International," the majority of its members—namely, 130—were French; the foreign members, representing Spain, Portugal, Belgium and the Netherlands, numbered 30 only. Great Britain, Denmark, Germany, and Italy had no representatives. The Congress was divided into two groups: the first, styled "Théorie générale de la Colonisation," contained three sections, viz. (1), Colonial Populations and Products, (2) Colonisation, (3) Organisation of Colonies: the second group, entitled "Applications," had two sections only, (4) French Colonisation, (5) the Colonisation of other European States. The meeting does not appear to have been a success. The subjects proposed for discussion were too numerous and far-reaching to be properly handled within the allotted time. Owing to the large preponderance of French members, general questions were frequently discussed as they affected French Colonies only; and even in the fourth section no new information or effective suggestions were elicited. No resolutions were passed. Lisbon was selected as the next place of meeting.

Population of Sweden.—The statistical department at Stockholm gives the population of this kingdom at the end of 1888 as 4,748,257, of whom 2,301,104 are males, and 2,447,153 females. At the end of 1886 the number was 4,717,189. The rural population amounts to 3,888,049, and the urban to 860,208. The latter shows a considerable increase, partly at the cost of the former. The following are the numbers of inhabitants in the large towns:—Stockholm, 234,990 (223,063 in 1886); Gothenburg, 99,647 (in 1886, 92,805); Malmö, 46,283 (in 1886, 45,346); Norrköping, 30,836 (in 1886, 28,993); Gefle, 22,019 (in 1886, 21,097); Upsala, 21,710 (in 1886, 20,955); and Karlskrona, 20,354 (in 1886, 19,497.—*Globus*, Bd. lvi., No. 13.

Heights in the Southern Ural Mountains.—In the same publication are given the results of a series of measurements taken in these mountains, from which it appears that Mount Irmel (5245 feet) must resign its claim to be the highest summit in favour of Yaman Tau (5399), which lies to the south-west of Mount Irmel.

Russia: Kuban.—*Petermann's Mitteilungen*, Vol. 35, No. ix., contains an account, extracted from the magazine of the Royal Russian Geographical Society, of a journey made by N. Kusnezow in the Kuban district during the Summer of 1888. Starting from Ekaterinodar, he made first for the river Shebsh, which he explored to its source. Then, passing along the spurs of the Caucasus, he came to the Beilaia and to the town of Maikop. This country is 2000 to 3000 feet above the level of the sea. Here is the zone of the oak; and the flora of this tract is marked by the presence of Trans-Caucasian forms. The upper course of the Beilaia and the mountain groups of Oshten and Fisht separate this tract from the rest of Kuban, which is characterised by the presence of the four zones of the oak, the birch, the white pine, and Alpine vegetation. From the Beilaia M. Kusnezow proceeded to the Black Mountain, and made excursions through the valley of the Sagdan to the sources of this river, and also of the Laba, the Urup, and the Kiafar. This part of the Caucasus is but little known, and a path had often to be cut with the axe through the primeval forest. The red pine (*Pinus abies*) was found here, and its western limit determined.

Area and Population of the Russian Empire.—The *Deutsche Rundschau*, Heft 12. 1889, gives a series of tables showing the area and population of the Russian

Empire. They are extracted from the work of General Stebnizki, Chief of the Russian Survey, and are based on the measurements and enumerations undertaken in 1884 and 1885. The Russian Empire in Europe and Asia has a frontier of 43,000 miles in extent, of which 12,383 miles are coterminous with other countries, and 30,618 have the sea as a frontier. The area of the Empire is more than $\frac{1}{12}$ of the earth's surface, $\frac{1}{6}$ of the total area of land, and nearly $2\frac{1}{2}$ times as great as that of Europe.

The following table gives the areas and populations of the larger divisions of the Empire :—

Russian Empire	Area in Square Miles.	Population.	Pop. per Sq. Mile.
In Europe—			
The 50 Governments of European Russia, excluding those parts which belong to Asia, . .	1,818,582	79,912,061	49·3
The 10 Governments of the Kingdom of Poland, ...	49,156	7,960,304	162·0
The 8 Governments of Finland, .	144,248	2,176,421	15·0
The Northern Caucasus up to the crest of the main chain, . .	102,803	2,798,754	27·2
The Sea of Azov, ...	14,519		
Total for European Russia, . .	2,129,308	92,847,540	43·6
In Asia—			
Transcaucasia, ...	79,645	4,485,793	56·3
Siberia, ...	4,925,684	6,215,463	1·3
Central Asia, ...	1,329,825	5,238,439	3·9
The Caspian and Aral Seas, . .	195,538		
Total for Asiatic Russia, . . .	6,530,692	15,939,695	2·4
Total for whole of Russian Empire, .	8,660,000	108,787,235	12·6

The total area of the islands belonging to Russia is 55,573 sq. miles. The largest are Novaia Zemlia, 35,162 sq. m., Saghalien, 29,098 sq. m., and Kotelnoi, 4175 sq. m. The area of the Caspian Sea measures 169,373 sq. miles, and that of the Aral Sea 26,165 sq. m. The area of the Sea of Azov has been given above. Ladoga and Onega contain 7000 and 3765 sq. m. respectively. The largest river of Asiatic Russia, the Obi, is 3233 miles long, and drains a basin of 1,150,520 sq. miles. The length of the Volga is 2215 miles.

ASIA.

Central Asia.—The following notes are taken from *Petermann's Mitteilungen*, Vol. 35, No. ix. :—

The annual report of the Russian Geographical Society gives further details concerning Grombtchevsky's journey over the Pamir plateau and the Hindu Kush. On 2d July 1888, Grombtchevsky set out from Margilan, and, passing Kara-Kul and Rang-Kul, reached the Murghab River, where he was intercepted by a strong band of Chinese Kirgiz. These he managed to elude by making a detour ; but, having entered Afghan territory, was pursued by the troops of that country

until he succeeded in crossing the Hindu Kush by the Wachjir Pass, 16,100 feet high, and entered the small state of Kunjut. This state was visited in 1886 by the Lockhart mission to Badakshan. After a sojourn of seven days at the capital, Baltit, Grombtchevsky endeavoured to reach the Karakorum range by the upper Raskum Daria ; but, when only 13 miles from the point where Younghusband crossed the Karakorum in 1887, he was obliged to turn back, owing to the failure of his supplies. Travelling by the spurs of the Pamir and Kashgar, he reached Margilan on November 27. He has brought back numerous records of observations to determine the latitude and elevation of various points, and the topographical department of the General Staff are engaged in preparing a large map of the south-eastern Pamir from the data he has furnished. On July 13th Grombtchevsky left Margilan on another expedition to the region south of the Hindu Kush. He passed through Karategin and Darwuz to Kila Khumb on the upper Oxus, intending to proceed to Shignan, where he wished to visit Lake Shewa, but the Afghan troops would probably prove an obstacle.

Meanwhile Kunjut has again been visited by a British political agent. Captain Durand, the newly-appointed British Resident at Gilgit, on which Kunjut is dependent, arrived at Gilgit on July 27, and continued his journey to Hunza, which, according to Grombtchevsky, is more correctly called Baltit.

The Austrian traveller, Dr. J. Troll, passed last winter in Chinese Turkistan, and made a journey to Khotan. At the beginning of May he left Yarkand, and, crossing the Karakorum Pass, arrived in the province of Ladak in June. He has therefore passed from Russian Turkistan to India through Chinese Turkistan.

The expedition to Tibet, set on foot by General Prjevalsky, has been successfully led across the Thian Shan Mountains by Colonel Pevtzov. On June 26th it arrived at Yak-Huduk, whence it followed the Yarkand River, the course of which had not been determined before, and reached Yarkand on July 15th. It proceeded to Khotan on July 20th. Pevtzov intended to spend the hottest part of the year in the highlands south of Karghalik, where the roads from India and Tibet meet. Before starting on his journey, Colonel Pevtzov worked out the results of the observations of elevation, longitude, and latitude, taken by him in Western Dzungaria in the year 1882. The results are published in the magazine of the Russian Geographical Society, No. xxv., 1889.

The well-known Altai explorer, N. Yadrintzev, travelled this summer into the southern district of Transbaikal and the adjoining parts of Mongolia, principally with a view to discover why this country, which some centuries ago was highly cultivated, is now a perfect waste.

Last October, according to the *Times*, Mr. W. W. Rockhill, formerly Secretary to the American Legation in Pekin, and a well-known Tibetan scholar, left the United States for the purpose of undertaking a journey into Tibet. He started from Pekin, and, on arriving in Mongolia, disguised himself as a pilgrim and succeeded in joining a caravan about to start for Lhassa. He got to within thirty days' journey of the sacred city when he was discovered, all his baggage was seized, and in this destitute condition he was forced to turn his face towards China. At the beginning of August he reached Chung-King, on the Upper Yangtse, having travelled over ground hitherto untraversed by any Western explorer.

AFRICA.

Italian Possessions in Africa.—According to the *Annuario Statistico Italiano*, 1887-88, the northern limit of the Italian possessions on the Red Sea has been

advanced to Ras Kasar, in 18° 2′ N. lat., while the southern limit is formed by the as yet undefined southern boundary of Raheita, towards Obok. To the west and north-west of Massowah, the tribes of the Habab, Beni Amer and others, have recognised the Italian protectorate, which therefore extends to the Upper Baraka and to the middle course of the Anseba. The population is estimated at about 220,000. A map, on the scale of 1 : 800,000, of the Italian possessions and protectorate to the north and west of Massowah, has been prepared by Professor P. Durazzo.

This year the Italian territory has received a far greater addition. Keren and Asmara were occupied by Italian troops immediately after the death of King Johannes of Abyssinia. King Menelik of Shoa, who claimed the succession, and subjugated successively all the provinces of Abyssinia except Tigré, despatched an embassy to King Humbert, the result of which is that the new Negus has acknowledged the protectorate of Italy over Abyssinia, and its sovereignty over the territories of Massowah, Keren, and Asmara. Asmara is being fortified, and the route from Saati to Asmara will be made practicable for carriages. At present the carriage-road extends only to Ghinda, which has been fortified and placed in telegraphic communication with Massowah.

Furthermore, according to *Cosmos*, 15th August 1889, the Italian possessions are said to include a part of the Somali country. We are told that, at the end of 1888, Yusuf Ali Yusuf, Sultan of Opia (or Obbia), belonging to the powerful tribe of the Mijjerthain, sought the protection of Italy, which was granted by an agreement made on February 8, 1889. Hereby the littoral from Cape Warrishin (about 2° 30′ N. lat.) to Ras Awad (5° 33′ N. lat.) was added to the protectorate. Again, on April 7, the Sultan of the Mijjerthain, Osman Mahmud, ceded to Italy his right of sovereignty over the territory between Ras Awad and Cape Beduin (8° 3′ N. lat.). How far inland this protectorate is supposed to extend is at present uncertain; but probably, says Cosmos, it includes the lower part of Wadi Nogal and Mudug—both fertile and well-watered districts. The distance from Cape Warrishin to Cape Beduin is about 450 miles; and, supposing that the zone is 30 to 60 miles across, this new accession of territory would have an area of 13,500 to 27,000 square miles. If, however, the lower part of Wadi Nogal, Mudug, and other districts further south be included, the area would attain to more than 46,000 square miles.

Professor Guido Cora is engaged in calculating, by means of the planimeter, the areas of all the Italian possessions and dependencies in Africa. In the meantime he has given, in the following table, the approximate areas of the principal divisions :—

	Square miles.	
Possessions.		
(1.) Region of Massowah (as far as the Middle and Upper Lebka and to 16° N. lat.), including Keren and Asmara, about .	2990	
(2.) Archipelago of Dahlak and the adjacent isles, ...	420	
(3.) The territory of Assab, including Beheta and Beilul, and as far south as Ras Sinthiar, ...	550	
		3960
Protectorates.		
(4.) The lands of the Habab, Bogos, Beni Amer, etc. (as far south as 15° N. lat.), . .	9920	

	Square miles.	
(5.) The littoral of the Afâr or Danakil and the Sultanate of Raheita (islands included),	6250	
(6.) The Sultanate of Opia and the littoral northwards as far as Cape Beduin (extending inland 31 miles),	13,510	
		29,680
SPHERES OF INFLUENCE.		
(7.) The inland parts of the territories of the Afâr or Danakil and the Sultanate of Aussa,	31,150	
(8.) The inland part of the Sultanate of Opia and the adjacent lands (up to the Lower Nogal and to Mudug),	32,810	
		63,960
Grand total,		97,600

Senegambia.—In accordance with the terms of a treaty made in May 1886 between France and Portugal, a Commission was sent out the following year to determine more accurately the boundaries between the colonies of the two nations on the Upper Guinea Coast of Africa. It was not intended to mark out the boundary far into the interior—a work which would take years to accomplish; but the limits were defined near the coast and in the neighbourhood of settlements and factories. The members of the Commission could not come to an agreement as to where the boundary between the Casamance and Cacheo should reach the coast. Captain Brosselard, chief French Commissioner, has written a monograph on the development of the Portuguese colony of Upper Guinea (*Bull. Soc. Géog. Lille*, 1889), in which he prophesies that the enormous expense which this territory entails on the mother-country, the disturbances which prevail, and the consequent decline of trade, will end in the downfall of the colony, and that France will eventually be obliged to acquire this territory by exchange for the sake of its own adjacent colony. A map on the scale 1:1,000,000, in which the observations taken by the Commission have been made use of, accompanies the article. A map is to be drawn on the scale 1:200,000. Brosselard's map agrees in general with one on the scale 1:500,000, published by the Cartographical Commission in Lisbon. M. A. Mingurin has published a description of the region of the Casamance, accompanied by a very detailed but roughly executed sketch-map (*Bull. Soc. Géog. Commerc. Bordeaux*, 1889, pp. 417-448). It contains a large amount of information regarding the course of rivers, their importance as a means of communication, the settlements and factories on their banks, and also about the natives, their manners and customs, and—principally—trade and commerce. The author comes to the conclusion that the so-called Rivières du Sud are the most promising part of the colony, and that French capital should flow to this territory rather than to the northern districts, which consist to a great extent of barren tracts.—*Petermann's Mitteilungen*, vol. 35, No. ix.

ARCTIC REGIONS.

Spitzbergen Group: King Charles Land.—A short account of the King Charles Islands is given by Dr. W. Kükenthal in the *Mitteilungen* of the Bremen Geographical Society, from the forward proofs of which we make the following translation:—The first reliable report of the existence of land to the east of

Spitzbergen was made by the third Swedish expedition in the year 1864. From the white mountain lying between Hinlopen Straits and Helis Sound the explorers perceived a high mountainous country with two conspicuous, rounded summits, which they supposed to be the somewhat mythical Gillisland.[1] The distance was estimated at about 150 kilomètres (93 miles). It appeared in the maps under the name 'Schwedisches Vorland.' We may pass over several reports, brought principally by fishing vessels and containing nothing new or reliable, and refer in the next place to the detailed report of Heuglin and Count Beil in 1870. From the Middendorf Mountain on the Walter Thymen Strait they caught sight of a hilly country with numerous sharp peaks, which was about 66 kilomètres (41 miles) distant, and extended from 78° to 79°, and perhaps even to 80°, N. lat. Petermann named this land "König Karlsland." No doubt was entertained but that it was in some way connected with the "Schwedisches Vorland." More exact information was first obtained in the year 1872 by some Norwegian fishing vessels, which penetrated into this region. Captain Altmann of Hammerfest declared that König Karlsland consisted of three large and several small islands, whereas Captain Nils Johnson of Tromsö was of the opinion that the supposed islands were united by low land into a single whole.

The map of King Charles Land as we now have it was drawn chiefly from these reports. In 1884 it was enriched by the discovery, made by Captain Johannessen and Captain Hemming Andreassen, of two islands lying to the east of King Charles Land, which were said to extend to the east or north-east as far as about 79° 20′ N. lat. and 38° 39′ E. long. King Charles Land is represented on the maps as continuous land, having two islands on its eastern side, the north-eastern point of which is about 35 geographical miles from the Swedish Foreland. As we have been four times this year among the King Charles Islands in the Tromsö yacht *Cecilie Malene*, commanded by Captain Magnus Arnesen, we are in a position to communicate some facts greatly at variance with former reports.

Our four journeys to those islands took place as follows: We made our first expedition from the Ryk Ice Islands, and on June 24th we found ourselves at the edge of the ice, 5 or 6 miles to the south of the eastern extremity of the islands. On July 3d we sailed from North-East Land towards the islands in a south-westerly direction. The weather being extraordinarily clear, we obtained a view of the whole group. In the course of the day we drew in towards shore, and then sailed along the west coast (the Swedish Foreland), which was here and there free from ice, for about 2 or 3 miles to the south, where we fell in with large masses of ice. In the evening, when we were about 20 miles to the south of the islands, we were able, owing to the clearness of the air, to take a survey of the whole group from this side also. We made a third journey a few days later from Barents Land. We reached the south-west coast on July 6th, and sailed amidst the ice towards the coast, keeping at an offing of about 2½ miles on an average, which gave us an opportunity of becoming better acquainted with the south and south-east coasts. As snow-storms and mist came on and the ice floes became more numerous towards the east, we had to put about. We sailed across the Olga Strait on the fourth occasion, and, approaching the west coast on the morning of August 12th, followed it southwards. This time the coast was blocked by a thick girdle of pack ice varying from ¾ to 2½ miles in breadth. We did not reach the east coast, for the fog, which continued all day long, and the danger of being hemmed in by the heavy

[1] See *Scottish Geographical Magazine* for last month. Page 559.—Ed.

masses of ice descending from the east and north, forced us to return to Spitzbergen. We observed the west and south coast more thoroughly, but we obtained a glimpse, at any rate, of the north and east coasts. The result of our observations is as follows :

Between 26° 20′ and 30° E. long. and 78° 30′ up to 78° 57′ N. lat. there lies a group consisting of at least two, and probably three, islands. The most westerly of these islands has its longer axis in a north-westerly and south-easterly direction ; its north cape lies between 78° 50′ and 78° 51′ N. lat., and its south cape at about 78° 30′ N. lat. ; its greatest length is about about 30 miles ; it is about 4½ miles broad at its northern end and about 9 at the southern. The northern extremity is occupied by a large square mountain, with steep, rocky base, the summit of which forms a plateau dipping slightly from north to south ; its height may be about 1200 feet. This isolated mount is visible at a considerable distance, and may be seen after the adjoining coast has disappeared. A narrow valley separates it from the succeeding plateau, which occupies the whole interior of the island, has a mean elevation of 500 to 600 feet, and rises a little at the northern end as well as at some prominent points on the west coast. It attains a more considerable elevation at the south, where the south-east coast, 9 miles broad, is formed by the slope of this plateau, here more than 1000 feet high. On the west coast down to the south cape a stretch of flat land, sometimes expanding to a breadth of 4½ miles or more, lies between the plateau and the sea. On the south-east coast this low tract vanishes, and on the north-east coast it is very narrow and rather higher. We noticed on this coast land, which generally rises gently in terraces, large quantities of drift-wood. This fact is quite in harmony with the existence of a strong sea-current coming from the north, the presence of which we observed all over the Olga Strait region from North East Land onwards. Another time we will describe its peculiar behaviour. At the south cape the land lying at the foot of the slopes is considerably higher. Here a huge, perfectly isolated rock, not unlike a church, rises to a great height and forms a very good landmark. The only glacier we came across was on the south coast, about a couple of miles from the southern cape : it was insignificant, and had a steep fall. There were three bays—namely, two shallow ones on the west side, separated by the long south-western cape, and another, smaller but deeper, on the south-east coast : it was about 4½ miles broad, and the same in depth ; its western bank is formed by the slopes of the plateau, which here bend round to the north, and its eastern bank by the low but steep-flanked east cape. As regards the east coast of this island we can speak of its northern part only. A low tongue of land runs out from the northern mountain in an east-north-easterly direction. The adjoining coast is also low. The rock of which the island is composed is of a reddish brown colour in the north, in the west and south more of a greyish brown. The whole construction is similar to that of the eastern and southern coasts of Stans Foreland. Dredgings near the coast produced also the same stones ; grey clayey sandstone and hypersthenite. The vegetation, as far as we could see, was very scanty : we could not perceive any reindeer ; the only mammal noticed was a polar bear. Even on August 12th the mountain slopes and a large part of the low land were covered with snow.

The sound which separates these islands from the land on their eastern side is nearly 14 miles broad at its northern opening. The direction of the northern coast of this land is east-north-east ; of the coast skirting the sound south-south-west. The western cape lies in latitude 78° 51′ N. ; the north-east cape at about 78° 57′ N. lat. A plateau of about the same elevation as that on the

western island forms the western extremity of this island, and falls rapidly to the sea on all sides. On the north coast we noticed three mountain spurs in succession. Eastwards this table-land is succeeded by a broad snow-covered declivity, which terminates in a narrow lofty ridge of rock. Then follows a stretch of snow-covered coast land extending in a northern and southern direction, but whether it was connected with the land just mentioned or was separated by a bay or sound, we were unable to ascertain: it is terminated to the east by a broad table-land. To this succeeds low rising land ending at the north-east cape, a mountain with a rounded summit. We caught sight of the south and south-east coasts on the evening of July 3d, as we lay to the south-west of the south cape of the western island. They became more and more conspicuous as we advanced further to the south, and we could clearly perceive that they were formed by the slopes of a table-land.

Such is the general idea we formed of this group of islands from our observations; later on we intend to render it more intelligible by means of a sketch-map and a few landscapes, which we were able to paint in water-colours. We do not venture to combine our own information with that before obtained, but leave it to more practised hands. But, perhaps, we may be permitted to make known our personal opinion on one important point. For various weighty reasons, as we believe them to be, but which we have not space to explain, we hold that the group of islands we saw are the King Charles Land marked on maps and discovered in 1884 by Johannessen and Andreassen. We are convinced that Captain Johnson in 1872 landed on the east point of the eastern island, and that the limit of the group towards the east-north-east must be moved at least eight degrees of longitude to the west.

OCEANOGRAPHY.

Mean Heights of Continents and Depths of Oceans.—*Deutsche Rundschau*, vol. xi., No. 12, contains a table of General A. v. Tillo's calculated mean heights of the continents and mean depths of the oceans. They are as follows:

MEAN HEIGHTS.

	Feet.		Feet.
Europe,	1040	The Continents of the Northern Hemisphere,	2339
Asia,	3139	The Continents of the Southern Hemisphere,	2079
Africa,	2007	All the land of the earth,	2273
North America,	2040		
South America,	2024		
Australia,	787		

MEAN DEPTHS.

	Fathoms.		Fathoms.
Pacific Ocean,	2394	Arctic Ocean,	1983
Atlantic Ocean,	2212	Antarctic Ocean,	2146
Indian Ocean,	2008	The waters of the globe,	2079

Scientific Expedition to the Atlantic.—On 15th July 1889 the steamer *National* sailed out of Kiel harbour, having on board a party of physicists who have been sent out by the Royal Academy of Sciences to explore the depths of the Atlantic Ocean. Dr. Hensen, of Kiel, Professor of Physiology, is the chief of the expedition, and he is accompanied by Dr. Brandt and Dr. Dahl, zoologists; Dr. Schütt, botanist; Professor Krümmel, geographer; Dr. Fischer, bacteriologist; and Richard Eschke, marine painter. The expedition will sail first to Para, in Brazil, and then search the waters of the Argentine Republic and at Ascension Island. Its chief aim is to investigate the animal and vegetable life of the Ocean.—*Deutsche Rundschau*, vol. xi., No. 12.

Velocity of Currents in the North Atlantic.—The Coast and Geodetic Survey Office at Washington despatched the steamer *Blake* to carry out during the past summer some current measurements to the south of Cape Hatteras and to the south of the Nantucket and George shoals. Besides direct measurements, floats were thrown overboard to determine the direction and velocity of the current below the surface. Each float consists of a white rod 8 feet long, and rising 1 to 2 feet above the water. The upper end carries a simple metal vane, while four iron blades attached to the lower end receive the force of the current at a depth of 6 to 7 feet below the surface, so that the float is constrained to follow the direction of this current. The rod carries five glass tubes hermetically sealed and protected by sheaths of copper wire. Each tube contains a note in English, German, Spanish, and French, stating the time and place where the float was set adrift, and requesting the finder to mark down on it the date and place where he finds the float. It also contains an envelope addressed to "The Superintendent, Coast and Geodetic Survey, Washington, D.C." The "Notice to Mariners," No. 114, issued by the Office, requests the finder to take one of these tubes, and then let the float continue on its course. The tube should be broken with care, the note read and its directions followed, and then placed in the envelope, and forwarded direct or through the nearest American Consul.—*Annalen der Hydrographie, etc.*, Heft ix., 1889.

Icebergs in the South Atlantic.—The German barque *Palmerston*, Captain Cordts, came in sight of several icebergs to the north-east of Cape Horn during a voyage from Pisagua to Hamburg in 1887 (*Annalen der Hydrographie, etc.*, Heft ix. 1889). The first two sighted, on 3d November, lay about 1·5 nautical miles from the ship, in 49° 54′ S. lat. and 49° 18′ W. long. A large iceberg, which, measured trigonometrically, proved to be 620 feet high, was seen on November 4th in 48° 42′ S. lat. and 47° 18′ W. long., at a distance of 2·5 nautical miles from the vessel, in a direction south-east by east. The last seen was to the north-north-west of the ship, in 47° 48′ S. lat. and 45° 30′ W. long., on November 5th.

COMMERCIAL GEOGRAPHY.

The Telegraph Cables of the World.—In a note in *Petermann's Mitteilungen*, Vol. 35, No. ix., Dr. Supan gives the total length of cables, in working order at the present time, as 113,038 nautical miles. Of these 11,626 are national property (France has 3197 nautical miles), and 101,412 miles are in the hands of private companies. The most important are the Eastern Telegraph Company's (18,838 miles), the Eastern Extension Australasian and China Telegraph Company's (12,035 miles), and the Anglo-American Telegraph Company's (10,438).

The Regulation of the Danube—a work of much importance to the people of south-eastern Europe—has at length been commenced. The first blasts were fired at the Iron Gate early in September in the presence of the Hungarian Minister of Public Works.—*Globus*, Bd. lvi., No. 13.

Trade with Southern Provinces of China.—The French have long been seeking an expeditious means of communication with the southern provinces of China. *The Chamber of Commerce Journal*, 5th Aug. 1889, reports a discovery which promises to gratify their wishes to some extent. The Marquis de Mores has studied the basin of the Canton River, and in the course of his inquiries he

heard that caravans from Yunnan, Sze-Chuen, and other provinces, were in the habit of meeting at Posé, on the Son-ki-kong, a tributary of the Canton River, and a very short distance from the Tong-king frontier. On reaching the Son-ki-kong, accompanied by MM. Thorel and Van Driesche, the Marquis de Mores found that it was a navigable river more than 270 yards wide. This river might be placed in direct communication with French territory by a railway about 125 miles in length. At present the trade of the western provinces of China passes through Canton and is attended with great difficulty and enormous expense, and the time of transport is sixty to eighty days. It is estimated that this new route would save sixty days, on an average, so that Tong-king would have every prospect of becoming the outlet for the trade of the whole of Western China. The Red River, which has hitherto been looked upon as the only route into China, has a rapid fall, and ends in a muddy delta which affords no good anchorage. However, according to *Petermann's Mitteilungen*, Vol. 35, No. ix., a steamer has ascended the river to Laokai on the frontier of Yunnan.

The Marquis de Mores found colza, maize, buckwheat, and chestnuts, near the river Son-ki-kong. Tobacco, silk, and indigo also are cultivated in small quantities, and their cultivation would probably be much extended if the country were rendered secure from robbers. The exploring party returned to Langson and thence to Tien-Yen on the coast, a distance of 93 miles. The last part of their journey (37 miles,) was performed on the river Son-Tien-Yen, the only river in Tong-king which yields pure drinking-water and does not form a muddy estuary.

The favourable geographical position of Upper Burma, in regard to Yunnan, however, has not escaped the attention of the British Government; and in this connection it is interesting to note, as pointed out by the *Deutsche Rundschau* (Sept. 1889), that "By the opening of the Tungu-Mandalay line the latter town has been brought into railway communication with the port of Rangoon, which has now acquired considerable importance. The railway is to be continued to Bhamo, so that Yunnan and the adjacent provinces of the Chinese Empire will thus be connected with the sea by a much more convenient means of transport than at present exists on their eastern side. Rangoon, and indeed Burma altogether, will derive much benefit from this line."

New Japanese Ports for Foreign Trade.—Hitherto Japanese subjects have not been permitted to charter foreign vessels to sail from any but the five treaty ports. An imperial decree has, according to *The Times*, now been issued, allowing Japanese subjects to despatch foreign vessels to any one of nine other ports, and there to load them with rice, wheat, barley, flour, coal, or sulphur. These vessels may not be used in the coast trade, and permits must be obtained from the Finance Ministry. The new ports are: Yokaitchi in the province of Ise; Shimonoseki in Nagato; Hakata in Tshikuzen; Moji in Buzen; Kuchinotsu and Karatsu in Hisen; Misumi in Higo; Fushigi in Etchiu; and Otarn in Yezo. Of course all the ports of the empire will be opened unrestrictedly when the treaties with foreign powers permitting free trade, etc., come into operation.

MISCELLANEOUS.

We regret to hear that Captain Wiggins has again failed, or suffered some check, in his efforts this year to open up the proposed **Trade Route to Siberia** by way of the Kara Sea; but we await particulars.

The *Daily Chronicle* (Sept. 2d) reported the **Eruption of a Volcano** in the province of Erzerum, whereby the village of Kantjorik, about 37 miles north of the town of Erzerum, was entombed beneath a layer of lava. The volcano is fissured all over.

Captain F. Roberti has written a treatise for the Italian War Office containing all that is worth knowing concerning the tribe of the **Habab**. The map accompanying his paper is based chiefly on the observations of Munzinger and Heuglin and the later additions of C. Hagh.

Nature (25th July 1889) reports that the Government of **Queensland** have commissioned Mr. A. Weston to conduct an expedition to the northern part of the colony, namely, the district to the north-west of Cairns and of the volcanic lakes. His companions Broadbent and Bailey will devote themselves to collecting zoological and botanical specimens.

The Colonies and India, June 12, 1889, states that the New South Wales Branch of the Royal Geographical Society is sending out Mr. A. J. Vogan on an expedition into the interior of **Australia**. He will travel northwards from Fort Bourke to Pitchiri Creek on the upper Mulligan, and, after exploring the country from that point to the Herbert River, will make his way to the Gulf of Carpentaria or to Hughenden.

M. J. Borelli, the French traveller, claims to have made a most remarkable discovery. He visited Shoa and its tributary states during the years 1886-8. On his outward journey he found, he asserts, a subterranean channel connecting **Lake Assal** with the Red Sea, but gives no explanation of the fact that in spite of this communication the surface of the lake remains 570 feet below that of the Red Sea.—*Petermann's Mitteilungen.* Vol. 35, No. ix.

The route of the engineer M. L. Brichetti-Robecchi through the **Libyan Desert** to the Siwah oasis differs but slightly from the one repeatedly followed by former travellers. He left the coast at Ras-el-Kanais, reached Garah by St. John and Hamilton's route, and then followed the caravan road to Siwah. On his return to Alexandria he chose the inland route traversed by Cailliaud, Rohlfs, and others.—*Boll. Soc. Geog. Ital.*, May and June, 1889.

NEW BOOKS.

A Life of John Davis, the Navigator, 1550-1605. By Clements R. Markham, C.B., F.R.S. London: George Philip and Son, 1889. Pp. 269. Index, Maps, and Illustrations. *Price* 3*s.* 6*d.*

This is the pioneer volume of a new popular Geographical Series which is being produced by Messrs. Philip, under the editorship of Messrs. J. Scott Keltie, H. J. Mackinder, and E. G. Ravenstein. The motive of the series is to give the life-history of some of the leading explorers, more especially in connection with those regions of the world with which their names are most intimately associated, and to show the effect their respective achievements have had upon geographical discovery. The series is thus one that will recommend itself to geographers, and to that ever-increasing section of the community which takes an intelligent interest in the world outside of its own limited sphere. To be

thoroughly successful, however, the series will require to be popular—in the best sense of that term, of course: above all, to focus its data in such a manner as to give true literary perspective. If this is borne in mind by the succeeding writers, this series may fully claim to be, what it aims at becoming, "a fairly complete Biographical History of Geographical Discovery," the importance and value of which to geographers will be considerable. As each volume is to be written by a specialist, we may presumably depend on the information being accurate, the only danger being that of prolixity or too much insistence on purely technical and scientific points in which the general public cannot be expected to take an interest. It is in this latter respect that Mr. Clements Markham's volume alone invites criticism; but to us, as geographers, it is of course a special point in its favour. The author is a well-known authority on Arctic subjects, and, it is scarcely necessary to remark that he has marshalled his facts with his usual skill and precision.

John Davis was one of the most eminent seamen in the brilliant age of Elizabeth. His voyages were not all made to the Arctic Regions, in search of a North-West Passage; he sailed the southern seas on many an important expedition: as pilot to the first voyage of the East India Company, for instance, he rendered most notable service. But it is as an Arctic discoverer that his name is best known. He did for the Arctic Regions what Livingstone accomplished in so many parts of Africa: he charted correctly many regions outside of his own discoveries of which only imperfect information was given on existing maps; and he brought to bear, on everything he attempted, a thoroughly trained mind. Mr. Markham says:—"No navigator had previously entered those [Arctic] seas whose scientific knowledge was to be compared with that of John Davis." He was the author of *Seaman's Secrets*, in which he gave many "cunning conclusions," and of other writings on navigation and voyages. His eventful career from his birth at Sandridge to his tragic death in the Malacca Strait is given by Mr. Markham in considerable detail. The book concludes with a couple of valuable chapters "following up the work" of Davis in the Arctic Regions. The maps and illustrations are excellent and numerous.

The Ancient History of the Maori: His Mythology and Traditions. By John White. Sampson Low and Co. 4 vols. *Price* 42*s*.

It is impossible thoroughly to appreciate or criticise this work in the absence of the "Glossary and Appendix," which is referred to in the preface as explaining not merely the meaning of the Maori terms, but the bearing of various acts and customs mentioned in the text, and which without such explanation can only be understood by the very limited number—in this country at all events—of Maori scholars. It is to be hoped, then, that this omission may be speedily supplied. About one-half of the work consists of the Maori text of a number of myths and traditions, and the other half mainly of translations of these. It is inevitable that there should be some repetition in a work of the sort—*e.g.* when various versions of the same story are given—but the amount of it might, we think, have been reduced by more skilful editing; more might also have been done towards fixing, approximately at least, the dates in the more strictly historical narratives, and generally speaking there is an absence of method in the construction of the book, as well as of that editorial assistance so much needed in a work of the kind, and which Mr. White is, no doubt, specially capable of supplying. Having, however, said this, it is only fair to add that the matter of these volumes is full of interest. We have, first, the earlier Creation and other

myths, which it is instructive to compare with the versions of the same stories preserved in the various island groups inhabited by the same race from Samoa and Tahiti to Hawaii; then the accounts of the original migration of the race—no doubt an actual occurrence—from their traditional home in "Hawaiki"; and finally, the narrative of later tribal wars and migrations, bringing their history down to the present time, and incidentally containing abundant pictures of native life and habits, character, and superstitions.

The Year-Book of Commerce. Edited by KENRIC B. MURRAY. London: Cassell and Co., 1889. Pp. 292. *Price* 5*s.*

Now that so good a handbook of Commercial Geography as that of Mr. Chisholm, reviewed last month, has been published, and is likely to become a standard volume, we may anticipate for it a leading share in laying down the foundations of commercial education in this country. But the permanent value of such a book is of necessity restricted to general principles, and it must inevitably fall out of date in details. Its study at the same time creates an intelligent demand for full and recent commercial statistics in a cheap compact form, frequently revised, and easy of reference. Foreseeing the need of such a periodical, the London Chamber of Commerce have produced, under the laborious and discriminating editorship of Mr. Kenric Murray, the first number of a new *Year-Book*. The material is difficult to secure, the difference in the fiscal years of various countries, and the dilatory publication of statistics, accounts both for the lateness in the appearance of the volume and the varied dates of the most recent statistics.

A business review of 1888 serves as an introduction, and refers almost exclusively to British trade. Then follows a valuable succession of statistical tables and explanatory letterpress contributed by various eminent specialists, dealing with the imports and exports of the chief countries in the world, the trade in the chief commodities, railway and ocean-borne traffic, rates of wages, and innumerable other subjects of varying interest. A strenuous endeavour has been made to secure uniformity in money, weights, and measures; but it was found impossible to apply any one system throughout. Almost all the tables are historical, giving the results for from five to thirty years back, and thus possessing more than ephemeral value. It is impossible to criticise such a compilation in detail, but a few improvements may be suggested from a cursory inspection. It would be well if in subsequent issues the table of the national customs' revenue on page 78 were extended to include British colonies. There is no satisfactory information on tariffs in the book; yet this is a subject particularly adapted for treatment, and is not readily to be found elsewhere. The fact that there is no table of contents suggests that the arrangement is somewhat confused, and indeed the heterogeneity of the contents bids defiance to classification. In time, however, the order which a fairly complete index as yet fails to evoke may appear; and we confidently expect that Mr. Murray's *Year Book* will go on improving without encroaching on the domain of other books of the same class.

The Land of the Dragon. My Boating and Shooting Excursions to the Gorges of the Upper Yangtze. By WILLIAM SPENCER PERCIVAL, H.M.'s Civil Service, China. With Map of the Author's route. London: Hurst and Blackett.

It is still a moot question whether the Yangtze will ever become a great avenue for the introduction of Western commerce and Western ideas into

Sze-chuen and the rest of the back country of China. The gorges above Ichang and the obstructive tactics of the Chinese mandarins meanwhile block the way. But its attractions in the form of wild scenery and adventure, sport, and strange manners and customs are beyond all dispute. It was in search of sport and relaxation, rather than of new outlets of trade, that Mr. Percival ascended the Blue River as far as the Mitan Gorge, half-way through the narrows, and 1250 miles from Shanghai, though he pays heed also to the commercial aspects of the Yangtze, and gives a useful and interesting account of Mr. Archibald Little's efforts to carry steam navigation beyond the series of rapids. With the excitements and the scenery of the river he was more than satisfied. In the course of a life well filled with wanderings and perils, he had seen nothing that impressed him so much as the great jaws of the gorges—precipitous walls between 2000 and 3000 feet high, with the deep and contracted current dashing from point to point between—and the wonderful performance of the Sze-chuen boatmen in running the rapids. His turning-point was near the border-line of the provinces of Hoopeh and Sze-chuen, a lonely and desolate spot, where, he says, "the natives are so imbued with the gloom of the place that they never laugh and they never smile; they never talk excepting when necessary, and then all they have to say is said in as few words as possible, and then silence is again the rule." In a subsequent boating expedition to the lake of Taihu and the island of Toongdoongsin, Mr. Percival and his wife and daughter had a narrow escape from ill-usage at the hands of a fanatical Chinese mob. He has a good deal that is noteworthy to say on the subject of Chinese missions, the opium traffic, and other social, political, and commercial problems of the Middle Kingdom.

A Suburb of Yedo. By the late THEOBALD A. PURCELL, Surgeon-Major A.D.M. With Illustrations. London: Chapman and Hall.

Surgeon-Major Purcell's pictures of life and character in and around Yedo profess to be only sketches in outline, with here and there a dash of colour or a touch of shading. They are, perhaps, all the more appropriate to the subjects, which, in the text as in the accompanying illustrations, are handled with a crispness of touch and a life-like vigour quite Japanesque. It is melancholy, after following the author round the outskirts of the city, looking in upon the barber and the saké-dealer, listening to the story-teller and the flute-player, and taking a share in all the sunny and light-headed ways of the people, to know that the prose of imported European fashions has begun to spoil all the old poetry of Japanese life, and that the hand which wrote these bright sketches is still.

NEW MAPS.

EUROPE.

DIE UEBERSCHWEMMUNGEN AN DER UNTERELBE im Frühjahr 1888. Auf Grund örtlicher Ermittelungen dargestellt von Binzer. Massstab, 1 : 100,000. *Mitteilungen der Geographischen Gesellschaft in Hamburg*, 1887-88, *Heft* 2. *Hamburg: L. Friederichsen und Co.*, 1889.

ASIA.

KLEINASIEN, Topographische Aufnahmen im Nordwestlichen ——. Im Auftrage der Kgl. Akademie der Wissenschaften in Berlin ausgeführt von März bis November 1886, und gezeichnet von Rittmeister W. von Deist. Massstab,

1 : 400,000. Tafel 1, Das Gebiet des Kaikos und Unteren Hermos ; Tafel, 2 Itinerare in Phrygien und Bithynien.

KLEINASIEN, Skizze des nordwestlichen ——, zur Uebersicht der hauptsächlisten Reiserouten W. von Deists und der administrativen Einteilung Bithyniens. Massstab, 1 : 2,000,000. Tafel 3.

Petermann's Geographische Mitteilungen, Ergänzungsheft No. 94. *Gotha : Justus Perthes,* 1889.

BRITISCH-INDIEN, Karte der jährlichen Niederschläge in ——. Nach geometrischer Progression der Jahresmittel, von Wilhelm Krebs. Massstab, 1 : 16,200,000. *Deutsche Rundschau für Geographie und Statistik, Jahrgang* 11, *Heft* 12. *Wien : A. Hartleben's Verlag.*

ELBRUZ AND CENTRAL CAUCASUS, to illustrate the Explorations of 1888. Scale, 1 : 316, 800. *Proceedings of the Royal Geographical Society, June* 1889.

DIE GRUPPE DES ADAI-CHOCH IM ZENTRALEN KAUKASUS. Nach Skizzen und photographischen Aufnahmen Moriz von Déchys, sowie nach der russischen Generalstabskarte gezeichnet von Dr. B. Hassenstein. Massstab, 1 : 100,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 13. *Gotha : Justus Perthes.*

AFRICA.

EASTERN AFRICA, A Map of Part of —, prepared by authority of the Imperial British East Africa Company, by E. G. Ravenstein, F.R.G.S. Scale, 1 : 500,000. 9 sheets. *London : Printed and published for the Imperial British East Africa Company by George Philip and Son,* 1889. *Price* 12*s.*

The Imperial British East Africa Company could place the preparation of a map of her territory in no better hands than in those of Mr. E. G. Ravenstein. All friends of the Company and of the development of British enterprise in East Africa will welcome this important publication. Mr. Ravenstein has chosen for this compilation twice the scale of his well-known Map of Eastern Equatorial Africa, 1 : 500,000, so as to include a much greater amount of detail. He has not only made use of the maps of the most recent travellers, but also the important notes of their descriptions, which makes the map a still more reliable one. Three inset maps are given. Sheet 3 contains a very detailed drawing of the region of the Kilima-Njaro ; sheet 9 gives a plan of Mombasa : both are drawn on twice the scale of the map itself, 1 : 250,000. The third inset map is given on sheet 7, and indicates the region north of Victoria Nyanza and west of the Nile, on the scale, 1 : 1,500,000.

TOGO-GEBIET, Aufnahmen des Premierlieutenant Kling auf den Reisen zwischen Bismarckburg und Do Koffi, 1888-89. In Verbindung mit den von Stabsarzt Dr. Wolf, und Hauptmann von François eingeschlagenen Routen.

PALAWE, SALAGA, FASUGU, PESSI UND BATO (Togo-Gebiet), Forschungsreisen des Stabsarztes Dr. Ludwig Wolf, Mai 1888-April 1889, von der Station Bismarckburg nach ——. Nach den Aufnahmen des Reisenden und in Verbindung mit den schon bekannten Theilen. Massstab, 1 : 710,000.

Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten, Band II., Heft 3. *Berlin : Asher & Co.*

IM GEBIETE DES BENUÉ, Eduard Robert Flegels Reisen ——, 1882-84. Nach seinen Tagebüchern und Entwürfen construirt von Richard Kiepert. 3 Blätter. Massstab, 1 : 500,000.

Zeitschrift der Gesellschaft für Erdkunde zu Berlin, No. 140 *u.* 149, *Tafel* 2.

KAMERUN, Darstellung des Flusssystems des Meme, Massake, Rio del Rey und Akwa Jafe, zusammengestellt nach den Aufnahmen des Lt. z. S. Graf Bernstorff, Kommando S. M. Krz. Habicht (Jan. 1889), des Hauptmann Zeuner auf dem Wege zwischen Barombi und Bioko (Jan. 1889) und nach den schon veröffentlichten Material. Massstab, 1 : 375,000.

Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten, Band II., Heft 2. *Berlin : A. Asher & Co.*

CENTRAL CONGO REGION, Map of the ——, illustrating the papers by Captain Vangèle and Mr. J. R. Werner. Scale, 1 : 3,300,000.

Proceedings of the Royal Geographical Society, June 1889.

UNTEREN QUANGO, Aufnahme des ——, von Dr. Mense. Massstab, 1: 300,000.

Mitteilungen der Afrikanischen Gesellschaft in Deutschland, Band V., Heft 3, *Tafel* 10.

QUANGO UND STANLEY-POOL, Dr. Richard Büttner's Reise von S. Salvador nach dem ——. Gezeichnet von Richard Kiepert.

Mitteilungen der Afrikanischen Gesellschaft in Deutschland, Band V., Heft 3, *Tafel* 9.

TANGANYIKA BASIN, Map of the ——, to illustrate the paper by Mr. Edward C. Hore. Scale, 1 : 6,200,000.

Proceedings of the Royal Geographical Society, October 1889.

DIE OSTAFRIKANISCHE BINNENSEEKETTE, zwischen Kilimandscharo und Kaffa, 4° S. bis 6° N. Br. Nach Dr. Fischer, Thomson, Schuver, Cecchi, Borelli u. a. vornehmlich nach Teleki-Höhnels Aufnahmen entworfen und gezeichnet von L. Ritter v. Höhnel. Massstab, 1 : 4,000,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 14, *Gotha : Justus Perthes.*

ABESSINISCHEN HOCHPLATEAUS, Der Südostabhang des ——, aufgenommen von Dr. Anton Stecker. Massstab, 1 : 500,000.

Mitteilungen der Afrikanischen Gesellschaft in Deutschland. Band V., Heft 3, *Tafel* 5.

QÉNÊH A BERENICE, Carta originale della via da ——, specialmente secondo i rilievi eseguiti nel 1873 da R. E. Colston. Colonnello dello Stato Maggiore Egiziano contrutta e desegnata da Guido Cora. Scala, 1 : 830,000.

Cosmos, Vol. X., 1889, 1. *Torino : Guido Cora.*

NORTH-WEST MOROCCO, Map of ——, showing local Distribution of Tribes, by Walter B. Harris. Scale, 1 : 1,500,000.

Proceedings of the Royal Geographical Society, August 1889.

OROTAVA, TENERIFE, Das Thal von ——, Aufgenommen und gezeichnet von Dr. A. Rothpletz. Massstab, 1 : 50,000. Nebenkarten. Geologische Skizze von Tenerife, 1 : 1,000,000. Querprofil durch das Thal von Orotava, 1 : 50,000.

Petermann's Geographische Mitteilungen, Jahrgang 1889, *Tafel* 15. *Gotha : Justus Perthes.*

AFRIKA, Karte der verschiedenen Elfenbein-Arten und Handelsgebiete in ——. Von Paul Reichard. Massstab, 1 : .

Deutsche Geographische Blätter, Band XII., Heft 2, *Tafel* 4. *Bremen : G. A. von Halem*, 1889.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SOUTH COAST OF WEST JAVA.

(*Read at Meeting of British Association*, 1889.)

By H. B. Guppy, M.B., F.R.S.E.

As the south coast of West Java is out of the usual track of the ordinary tourist, and is only occasionally visited by adventurous sportsmen in quest of tigers and other big game, I intend giving in this paper a short account of my travels on foot in this region a few months ago. During a period of between six and seven weeks I walked about 560 English miles, and practically crossed the island three-and-a-half times on foot. Junker and Veth, with others, have made the interior of this part of Java well known in their writings, and it will therefore be best for me to confine my remarks to the little-known south coast. I shall only touch lightly on the geological observations, the principal fruit of this journey, as I hope sometime to publish them after my collections have been examined. My equipment consisted in a Gladstone bag and a rifle, which were carried by two coolies, and I was generally on foot from 6 A.M. to 3 P.M.

The sea-border of the Residency of Preanger, between Capes Genting and Mandaran, is for the most part an undulating country, composed of foraminiferous clays and marine tuffs, and covered with the jungle-grass, 6 to 8 feet high, with here and there patches of wood and forest. These are the prevailing characters of this part of the sea-border of Java for a distance of from ten to fifteen miles inland. Its general aspect is most uninteresting to the traveller, especially to the pedestrian, who finds no shelter from the sun's rays, and is obliged to walk in the heat of the day, since the tigers that infest many of the districts on the south coast are only to be feared in the dusky hours. Fortunately the remains of the old forest that remain in places afford a pleasant change, but they in no way materially redeem the general tameness of the country. One of my

first descents to the coast was from Garoet through Soekeradja to Tjipatuja, a remote and isolated hamlet, consisting of about a dozen houses, and situated close to the beach. From this place I walked along the beach to Ranzaherrang, seventeen miles to the westward, a very uncomfortable tramp, as the dark volcanic sand was so hot that my coolies could only walk on the wet surface close to the water. This sand contains a large quantity of magnetite, which, on account of its greater specific weight, is sorted by the waves on the beach, where it forms black metallic patches on the sand. Between Tjipatuja and Ranzaherrang we did not meet a soul, and found only one deserted dwelling. It is in fact one of the most lonely and deserted parts of the south coast, being much frequented by wild animals; but we saw nothing to frighten us, with the exception of wild pigs and buffaloes. Several rivers were crossed, mostly fordable; and here I may remark that as a general rule the larger rivers have a bar of sand thrown up at their mouths and open into wide lagoons, which give them the appearance of being deflected westward.

A coral reef, 200 to 500 yards in width, fringes the shore for a few miles east of Ranzaherrang; it commences about a mile from that village, and terminates near a headland about four miles further east. This was the only coral reef that I observed along the portions of the coast that I became acquainted with between Capes Genting and Mandaran; and it is evident that coral reefs are very scanty on this coast. Beaches of the dark volcanic sand, on which the heavy rollers break without the intervention of coral reefs, form the prevailing feature of the coast. Landing can rarely be effected on any part of the 130 miles of coast between these two capes. On this unprotected coast, in fact, ships cannot anchor and boats cannot land. Sea-fishing, therefore, is not the employment of the sparse coast population; and, in truth, the only fish caught are those obtained in the lagoons into which the rivers open, such lagoons often swarming with fish and communicating freely with the sea. In the place of the large prahus, such as we find in Palabuan or Wynkoops Bay to the west of Cape Genting, we notice here mere small and crank dug-out canoes suited only for the quiet waters of the lagoons. Often two canoes are lashed together, 2 to 3 feet apart, forming a kind of double canoe; but even then I was always prepared for a ducking, whenever I made use of them in crossing the mouths of the rivers.

A low level sandy tract, varying usually between 200 and 500 yards in width, but sometimes much wider, and raised only a few feet above the sea, immediately borders the beach along the greater part of the coast between Capes Genting and Mandaran. Near the beach it is raised into a mound on which grow a species of *Pandanus*, *Crinum asiaticum*, *Scaevola koenigii*, *Calotropis gigantea*, and *Spinifex squarrosus*; whilst its interior is clothed with short grass and spurges. This sandy belt, which forms such a common and uninteresting feature of this coast, affords no shelter from the sun, and its monotonous and somewhat scanty vegetation presents a great contrast to the vegetation of those localities, where the wooded slopes of the hills reach the coast, or where, as at Ranzaherrang, a coral reef skirts the shore. In the locality just named we have bordering the reef-flat the common tropical littoral trees, including *Calophyllum*

inophyllum, *Tournefortia argentea*, *Guettarda speciosa*, *Terminalia katappa*, etc. Inside these shore trees, the road to Ranzaherrang passes through the skirts of the original forest, which is now rarely to be observed in its primeval grandeur, except in such remote districts as this. Tall buttress-trees and banyans, 150 feet in height, with the bird's nest fern (*Asplenium nidus*) attached high up their trunks, here shade the road, and numerous palms, including a *Caryota* and a *Calamus*, also occur. Here the hornbill finds its home, and large monkeys crash about among the branches.

West of Ranzaherrang the low sandy belt above alluded to as generally forming the immediate sea-border, widens out into a broad plain, some miles in width. This low tract of country has a sandy soil, but is well dotted with villages, and is to a certain extent under rice cultivation. Waro-trees (*Hibiscus tiliaceus*) line the road, and clumps of cocoa-nut palms mark the situations of the villages. It is on this plain that Pameungpeuk lies, a place of some size under a Wodana. West of Pameungpeuk, however, the country for many miles contains but few inhabitants. As we trudged across this deserted grassy plain on our way to the hamlet of Tjimari, about ten miles away, we were overtaken by the dusk, and were not sorry at last to reach our destination, since after dark the wilder animals here hold the sway. Tjimari was a wretched little place close to the coast, remote from everywhere, and containing only about half-a-dozen houses. I could get nothing but boiled rice and coarse brown salt for my dinner; and it was not a pleasing reflection that a day's walk inland would have brought me to the region of pine-apples, bananas, mangosteens, durians, and rambutans, all then in their full maturity. I could not even get fish, for sea-fishing is impracticable on that coast, and not even fowls could be obtained; there was nothing but this boiled rice and coarse salt; and I went dinnerless to sleep in a land of plenty. The next morning I was charged ten cents, or twopence, for the accommodation of the two coolies and myself, and from the manner of my host it was evident that he was nine cents in pocket.

The following day I followed the coast further west for another four or five miles, and then struck inland for Boengboelan, about nine miles distant and 1400 feet above the sea. Our way lay up a spur of the adjacent coast range, and for the greater part of the distance we traversed a district covered with the high jungle-grass, varied by clumps of the Gobang palm near the coast, and dotted with patches of wood further inland,—a grand country, in truth, for big game. I reached the large inland town of Tjikadjang, and once more became cognisant of the fact that Java belongs to Holland. On the south coast there is usually but little to remind one of this circumstance, since Dutch officials do not generally reside within 25 miles of this coast. Tjikadjang is elevated between 4000 and 5000 feet above the sea, and lies between the volcanic mountains of Tjikorei and Papendaya. However, as my paper is entitled the South Coast of West Java, I must leave at once this interesting and familiar region and descend in imagination to the south coast.

Between twenty-five and thirty miles further along the coast west of Tjimari is situated the town of Sindang-barang, which I reached on foot from the central railway at Tjibeber. The prevailing structure of

the sea-border between Capes Genting and Mandaran is here well exhibited. The land has the profile of a level though undulating country, rising gradually from the low coast until at a distance of about twelve miles inland it attains the elevation of 2000 feet. The whole thickness of this sea-border is composed of foraminiferous muds and marine tuffs of post-tertiary or later tertiary age; whilst here and there the rivers have worn steep and often vertical-sided valleys in its mass that possess a very small gradient. High jungle-grass covers the greater portion of its surface, whilst occasional areas of forest occur. This lonely country, as far inland as Tangoeng, twelve miles in a direct line from the coast, is but sparsely inhabited, and tigers and other wild animals do not always render the roads safe after nightfall. In fact, during my return walk to Tangoeng a buffalo had been carried off in the night by a tiger from a house at which I had slept. Two miles east of Sindang-barang the coast terminates in a line of cliffs, 40 to 50 feet high, which are composed of the foraminiferous muds and marine tuffs of the district. Across the mouth of the broad valley of the Sindang-barang river, sand-dunes have been formed; and away to the westward, as far as the eye can see, the coast is low, and the land rises very gently from the sea as an undulating plain clothed with tall jungle-grass.

There can be but little doubt that if the south coast of West Java had possessed some good harbours, which would have rendered it in some measure accessible for trade, this part of the island would now be in a very different condition. As things are now, we have between Cape Mandaran and Java Head a belt of sea-border 200 miles long, and on the average 15 to 20 miles broad, nine-tenths of which are still uncultivated, and, in fact, partake in not a few localities of the nature of a menagerie.

The next descent I made to the south coast began at Soekaboemi on the central railway, whence I reached Tjikaso, some thirty miles west of Sindang-barang; and after reaching Palabuan by crossing the Genting Promontory, I followed along the Bantam coast to Malingping, and then crossed the island, *via* Djassinga, to Batavia, this journey of 244 miles on foot occupying me eighteen days. From Soekaboemi I reached the south coast by Sagaranten and Rambai. South of Sagaranten, the road lies through the wooded range of Goenoeng Bentang, a picturesque district once much dreaded on account of the tigers that infested it, and at present by no means free from these pests, as the traps at the roadside indicate. It is however believed by the inhabitants of this locality that certain talismans in the possession of a recent settler scared off these animals for some years.[1]

On our way down to the sea from Rambai, we followed the right bank of the river, and traversed a wild district, in places densely wooded, and but little tenanted by man. Here some of the original forest is preserved; and hidden in the midst of this lonely region lies the dismal hamlet of Tjigangong. Well may the natives regard this locality with fear and superstition.[2] This peep at Nature in all her savage

[1] Veth's *Java*.

[2] *Ibid.* iii. 325.

loneliness had by no means an exhilarating effect upon me; and it was with a sense of relief that I reached the hamlet of Rawa-oentjal on the coast, and gazed upon the more cheerful prospect of the broad surface of the Indian Ocean. From here we trudged westward along the low grass tract that borders the sea. A warm tramp of six miles in the full blaze of the noon-day sun brought us to the hamlet of Tjikaso, which lies at the mouth of the Tjikaso river. Our arrival caused some astonishment amongst the limited population of this remote place. Six men, four children, four women, some twenty goats and three or four dogs, in fact all that was alive in the place, turned out to greet us. This was one of the most lonely and isolated places at which I stopped; but even here officialdom had its sway. The oldest man, who was the head (mandoor) of the hamlet, donned his official dark cloth jacket, which was going in almost every seam, and having found his kreese, stuck it in waistband, and duly received me. Being pretty well exhausted after our tramp in the sun, I regarded his movements with something more than impatience, and was very glad when the old man bent himself straight again and brought me a water-melon.

The life of the inhabitants of these lonely coast hamlets can in truth be only described as monotonous in the extreme. Here they seem to mainly sleep their lives away, their senses lulled by the never-ceasing roar of the surf on the beach; and in truth a few weeks' residence in such a hamlet as Tjikaso would have enabled me to realise the highest condition of Buddhist bliss. However, as events turned out, my first afternoon's experience had an effect in the opposite direction. Whilst writing up my notes, I received by a foot-messenger a letter dated from a place about 30 miles distant, in which a distant official desired to know whether I was travelling in search of minerals, and also where I was bound to. To remove suspicion, I replied civilly, sending also by the messenger a piece of foraminiferous clay, which probably did not enlighten my correspondent very much, nor do I think that he was much the wiser when I informed him in my reply that I was not in search of gold, but of evidence of the Post-Tertiary upheaval of the sea-border (!!). This important announcement was carried back another 30 miles, and was evidently quite beyond the province of the official, who, as recent events have shown, has more reason to fear the uprising of the natives than the upheaval of the land.

The mosquitoes at Tjikaso, owing to the vicinity of the river, were terribly vicious, and I had to sit up all night with two suits of clothes on and a pipe in my mouth; but they revelled in the tobacco-smoke, and treated my inland coolies just as badly as myself. Only the coast people seemed to be proof against their attacks. On the following morning we started westward along the coast, being accompanied by the mandoor and four of his men. For the first 3 miles we proceeded in a double canoe along a fresh-water lagoon, 150 to 200 yards broad, apparently not usually more than 3 or 4 feet deep, and extending westward from the mouth of the Tjikaso river. This lagoon, which was alive with fish, is bound on its inner side by inland cliffs composed of the foraminiferous clays so common on the sea-border; whilst on its outer or seaward side it is cut

off from the beach by a mound of drift sand, sparingly covered with the usual littoral vegetation. Along the coast to the westward, for 2 miles or more beyond the termination of the lagoon, extends a grassy plain, which, as the mandoor voluntarily informed me, had been in past time covered by the waters of the lagoon; and he pointed to a shallow fresh-water lakelet, that lay in the midst of the plain, as the remnant of this former extension of the lagoon. Having previously arrived at the same conclusion, from the evidence presented to my observation, evidence which I need not give in detail here, I was pleased to find it confirmed by local tradition. The remark of the mandoor, which began with "Orang deseenee beelang," etc. ("People here say"), was quaintly put, but gave me no information of the date of the change. Here we have, however, a partial explanation of the low, sandy, yet grassy tract, that borders the beach along a large portion of the coast of the Preanger Residency, in the lagoon-forming agency of the rivers at their mouths; but this is, as I point out below, only the latter stage of the process. These lagoons are subsequently left dry by the shifting of the river's mouth; and after that, sand blown in from the beach fills them up and forms the sandy plain. This sand is arranged in fine horizontal layers, and there are to be observed, imbedded in it, great numbers of the empty shells of *Pythia scarabæus*, an auriculoid mollusc that prefers moist ground, especially tracts bordering reef-flats. The imbedding of these shells in such numbers occurred during the swampy stage of the plain before the lagoon was quite obliterated by the sand blown in from the beach. In several localities on this coast *ancient coral reefs are exposed underlying this sandy belt or plain that now forms the sea-border*. There was a time, in fact, when a large portion of this coast was fronted by shore-reefs, which have since been *killed and overwhelmed by the great quantities of sand and mud brought down by the rivers, and have been finally covered over with drift sand from the beach* through the agency of the steady trade-wind. In this manner has been formed the *sandy belt or plain of dark volcanic sand overlying ancient reefs that is the characteristic feature of the south coast of West Java between Capes Genting and Mandaran; and the channels inside the old reefs have often been converted by the rivers into fresh-water lagoons, which have been in time obliterated by the drifting sand.*

Along the three or four miles of coast that intervene between the western end of the Tjikaso lagoon and the commencement of the Genting promontory are situated the three hamlets of Tjiroyo, Tjipako, and Tjikawoong. The inhabitants of these hamlets were all half-asleep before ten in the morning. On reaching the promontory we ascended by a partly overgrown track through the forest, that here reaches down to the coast. After passing a remarkable hole formed by the falling in of a sea-cavern, which was picturesquely bordered by palms, scitamineæ, and ferns, we entered a rolling grassy country, the footpath being often almost concealed by the high jungle-grass, and evidently but little used. There had been recently a royal tiger killed in this lonely locality, as one of my men pleasantly informed me, so I was glad when we reached the small villages of Tjikaret and Tjipundoy, the inhabitants of which were all in slumber. That night I slept at Tjiharassass, and the next

day I fell into a good road leading across the Genting promontory by way of Tjirajap, Sangarawa, and Tjiboetoeng to Palabuan, which I reached in a little over two days. My way during the first day led me through a rolling prairie-like country, gradually rising as far as the village of Sangarawa, which is about 1400 feet above the sea. On the following day I crossed the mountainous backbone of the promontory, and traversed a well-wooded district until I reached the village of Simpan, 2000 feet above the sea, from which there is a steep descent to Tjiboetoeng on the east side of Wynkoops Bay. The mountainous backbone of this promontory is formed of ancient volcanic rocks, such as quartz-porphyries, felspar-rocks, and old andesites, whilst the long low point is formed mainly of more recent foraminiferous limestones, which are not found at a greater elevation than 300 feet.

After crossing the Genting promontory I arrived at Palabuan, at the head of Wynkoops Bay, and from there I commenced a journey around the little-known Bantam coast to Malingping, a walk full of interest to me in spite of the numerous drawbacks. About eight miles west of Palabuan, on the shore of Wynkoops Bay, lies the village of Tjisolok. The road thither is shaded by magnificent old Yamploong and Katappang trees (*Calophyllum inophyllum* and *Terminalia katappa*), and by occasional banyans; and on the beach, which the road skirts, the botanist may find other familiar littoral trees, such as *Cerbera odollam* and *Hibiscus tiliaceus*. Arriving at Tjisolok at mid-day, I spent the night at the house of the Chamat, an intelligent official whom I had met on the previous day in the house of the Wodana of Palabuan. He supplied my men with a pass over the Bantam border, which we were to cross on the following day, a very necessary precaution, as I subsequently found.

This leads me to speak of the system of surveillance prevailing in all the remote parts of West Java that I visited. Only a very short time elapses before the arrival of a stranger is reported to the head of a town or village. Whether the stranger be a man of position or a coolie, a European or a Malay, he is obliged (or rather ought, in the case of a European) to report himself to, or call upon, the head of the place. The omission to do so may land the European in some unpleasant mess as regards his coolies, or may cause him some unexpected annoyance when he wants to be pushing on his road. The official, be he a Wodana or a Chamat, will require him to give his name, his place of departure, his destination, the length of his stay, and other particulars, which he carefully notes down, and often takes care to verify by comparing the answers he receives with any letter or passport the stranger may carry. In the less isolated places the visitor is given a book, in which he writes the above particulars. This information is sent to the Dutch Contrôleur of that part of the Residency, who may be twenty, thirty, or even fifty miles away. It is thus almost impossible for a suspected native, much less an unfortunate traveller, to escape detection for any length of time. As soon as ever he comes near a village to which he is a stranger, he is narrowly scanned by all passers-by, and the usual Javanese salutation, not of "How do you fare?" but of "Where are you going to?" or "Where are you coming from?" is addressed to him. The

persons who meet him speak of the stranger in the village; and the headman's lieutenant, usually a mantri, who is always loafing around, with ears and eyes open, hears it and reports it to his chief. In truth, the slightest occurrence that is at all out of the way becomes a topic for gossip, and is faithfully communicated to the head of the village, who nearly always has his house fronting the principal road. Seated here for many hours daily in his easy-chair under his verandah, he smokes cigarettes, and casts an observant eye around. In fact one of the chief duties of the chief of a village, besides receiving his evening reports from the overseers in charge of the Government coffee-plantations in his district, is to look out for gossip and note it down. He does, I fancy, a considerable amount of scribbling in this way.

Leaving Tjisolok at sunrise, a walk of about five miles brought us across the Bantam border into the village of Tjibarenoh, which lies near the sea-level and close to the coast. The Tji Barenoh, which here flows down to the coast, is the boundary river between the two important Residencies of Preanger and Bantam. According to Professor Veth's description of the locality, it is usually a difficult river to cross, and other naturalists have experienced difficulties here. When we crossed it the waters were much swollen by the rains of the previous day, and it was with a feeling of uncertainty that I embarked here in a cranky outrigger. However, nothing happened, and after crossing, we made for the village of Tjilograng, which was about 3 miles distant. On the way one of my men, rather too old for such work, was overcome by exhaustion and by the heat, and lay down in a semi-conscious state in the midst of the road. However, he soon recovered, but as I knew we were only just beginning our hard work, I deemed it best to pay him off and send him back to Palabuan. Tjilograng is elevated between 600 and 700 feet above the sea. Another 3 miles' walk brought us past the village of Tjipuru, which lies about 500 feet above the sea, to Sirwana or Sawarna, a small village near the coast, and but little above the sea-level. Here I put up for the night, as the next place, Baia, was 8 miles further on, to get to which I should have to traverse a lonely district, where tigers were apt to roam after dusk.

The day's tramp had been very tedious, the country between Tjisolok and Sirwana being wild and deserted, and very hilly, the road rising up at times to 700 or 800 feet. Compact limestones were the prevailing rocks on the way. Limestone caverns, in which edible birds' nests are found, are said by Professor Veth to occur at the mouth of the Sirwana river. I was not surprised to find that the country was mostly wooded, the tracts of tall jungle-grass, usually characteristic of non-limestone districts on the south coast of West Java, being here scantily represented. The lower hill-slopes are often occupied by a wild plantain which grows in great profusion.

This part of the Bantam coast, between Tjisolok and a point midway between Sirwana and Baia, is mostly cliff-bound and inaccessible, and the coast villages are usually cut off from communication with the sea. The noise of the rollers breaking against the limestone cliffs, perhaps a quarter or half-a-mile away, is unceasingly to be heard, but the sea is

hid from view by intervening hills. Removed as these villages are from the main roads, unapproachable by the sea, cut off from the interior by the adjacent mountainous district behind them, isolated on the east by the political limit of the Bantam border and by the rapid current of the Tjibarenoh river, they are rarely visited except by the Dutch Contrôleurs or by some eccentric individuals like myself. The people seem to be half-asleep, talk dismally of the tigers that infest this coast, and do not seem to care to stray far from their homes. They form indeed a contrast to the inhabitants of villages that lie near the principal roads, and are, so to speak, in the world.

Lying about eight miles west by the road from Sirwana is the village of Baia, where an assistant Wodana resides. The road between Sirwana and Baia for the first half of the distance traverses a limestone district, and is near the cliff-bound coast; it does not rise over 200 feet above the sea. This lonely uninhabited region is well wooded. Large monkeys are frequently to be seen in the forest; whilst tigers, according to the native reports, and judging from the number of traps at the roadsides, also abound. The latter part of the way lies near the shore over low wooded hills, not exceeding 400 feet in height, and composed of a hard tufaceous sandstone. Baia itself is a fair-sized village lying near a river in a broad valley, about a mile from the sea, as I was told, and not more than 50 feet above it. About four miles west of it is the small village of Pangerangan, which is said to be about two miles inland. Here I passed the night.

About nine miles west of Pangerangan by road lies the village of Tjiara, picturesquely situated on the left bank of the Tjiara river, which, on account of the depth of water, we had to cross on a bamboo raft. This coast-district is lonely and deserted; we passed only one house on the way at a place called Tjikirei. Tigers infest these parts, and I was shown one place close to the roadside where a man had been killed by one of these animals a short time before. Eight miles west from Tjiara occurs the small coast village of Tjilangahan, which was the furthest point I reached on the south coast of Bantam.

Above I have very briefly referred to the characters of the sea-border as far as Baia: I will now briefly refer to the coast between Baia and Tjilangahan. It is no longer cliff-bound, but is low, and mostly fringed irregularly by broken coral-reefs which begin opposite Pangerangan and cease two or three miles east of Tjilangahan. In the background are low level-topped wooded hills, which, when they reach the coast, expose in their sides the hard tufaceous sandstone previously alluded to, a rock which mainly composes the low hills backing the sea-border from a point three miles east of Baia to Tjiara. West of Tjiara coarse volcanic tuffs and agglomerates occur at the coast.

The littoral vegetation along the reef-girt coast between Baia and Tjilangahan is worthy of notice. Close to the beach, a species of *Pandanus* and *Crinum asiaticum* are most frequent. A little within the beach, the road traverses, often for miles, belts of fine old trees of *Hernandia peltata*, with which are associated in different places *Calophyllum inophyllum*, *Terminalia katappa*, *Cerbera odollam*, *Guettarda speciosa*, and an occasional *Tacca pinnatifida*, and *Cycas circinalis*.

Before leaving this south coast of Bantam, I should refer to the comparative absence of those extensive regions of jungle-grass so characteristic of the sea-border of the Residency of Preanger. The country is usually well wooded, except in places where the wild plantain grows in great abundance.

From Tjilangahan I started to cross the island, walking through Bantam to Djassinga and thence on to Batavia, a traverse of about 95 miles, which occupied me five days. After striking the large military road that leads across Bantam to Sadjira, I arrived at the town of Malingping, which lies between three and four miles from the coast. It was early morning, and not wishing to waste the coolest hours of the day in what I knew would be a lengthened interview with the resident Wodana, I did not call upon him. The result was that, much to my annoyance, I found myself pursued by a cavalcade of horsemen, including the Wodana and his staff of Mantris, who ran me down about two miles beyond Malingping. The usual questions were put to me, and my two men were closely questioned also, and their passports examined. There was no want of civility on either side, the Wodana politely dismounting to address me; but it was evident to me that if my replies had not been satisfactory they would have escorted us back to Malingping. I afterwards reflected that there was a little excuse for the chase, owing to the recent outbreak in Bantam; and besides, having been a fortnight on the constant tramp, I was beginning to look somewhat disreputable and an individual to be looked after. Soon after this occurrence we passed on the road the Chamat of Baia and his party returning homewards from an official visit to the Assistant Resident at Lebak. He rode on horseback, and was accompanied by his two wives, who were carried in a kind of palanquin on the shoulders of several men.

There is no need for me to give the particulars of my walk across the west end of the island, and I will merely remark that soon after leaving the town of Goenoeng Kendang we left the main road and struck off to reach Sadjira by a shorter track through the Bantam hills, passing through Tjigumbroon, Bodjong-Manik, and Tjiboenoet. From Sadjira I proceeded through Djassinga direct to Batavia.

My traverse from the south coast of Bantam to Batavia gave me an excellent opportunity of studying the configuration of the surface and the general structure of the west end of Java, and enabled me to form an opinion as to the supposed former connection of this island with Sumatra. The greater part of the northern half of the Bantam Residency is low and level, and rises with an almost imperceptible slope from the north coast until it attains an elevation of about 300 feet some 30 miles inland. From this plain-like region start up suddenly the mountain-cones of Goenong Karang and Poelo Sari, and one or two lesser cones. The watershed of this end of Java lies in the Bantam hills towards the south coast, the usual level of the country west of the Kendang Mountains being not greater than 600 or 700 feet, and only between 300 and 400 feet in the river valleys. The greater part of Bantam, excluding the cultivated districts of the plains and the hilly regions, which are usually wooded, is covered with young wood and shrubs, the rolling districts of

the jungle-grass so characteristic of the Preanger Residency being only here and there represented. The prevailing surface formations in Bantam are white pumiceous tuffs, in which are imbedded, especially in the central part of the Residency, great numbers of silicified trees. Such tuffs are evidently sub-aerial deposits, but they pass downwards into dark clays and tufaceous sandstones containing marine shells and occasional lumps of gum-resin. Further down still, exposed in the river-cuttings in the deeper valleys, we find the foraminiferous muds and marine tuffs so common in other parts of West Java. Here in Bantam, however, the sub-aërial tuffs, in which the silicified trees occur in such numbers, have for the most part concealed the foraminiferous deposits, which are only at times exposed; but I found these marine deposits amongst other places, at Tjiboenoet, in the heart of Bantam.

I have referred to the low and level character of the northern half of Bantam, but the same description applies to the whole northern sea-border of West Java as far east as Cheribon, and for a distance of 25 miles or more inland. For instance, to take the Residency of Batavia, if we walk from the north coast, near the town of Batavia, to Djassinga, 30 miles inland as the crow flies, we rise only about 250 feet, and traverse a level gently undulating region possessing no eminence worthy of the name of a hill. In the Residencies of Krawang and Cheribon, where the swamps at the sea-border extend many miles inland, one has to walk some 20 miles from the coast before attaining an elevation of 100 feet above the sea. Clays, loams, and loose sand-rocks, occasionally containing marine shells, seem to mainly compose this low-lying northern sea-border of West Java. There is but little to please the eye in any special degree in this low and level country which forms the greater part of the Residencies of Batavia and Krawang, and no small portions of those of Cheribon and Bantam. The surface is usually covered with grass, shrub, and paddy, and is dotted with numerous villages, which are usually concealed amidst bamboo brakes, cocoa-nut palms, and other trees.

The title of my paper does not permit me to refer to my traverses through Krawang and the interior parts and more familiar parts of the Preanger Residency; and I can only say that the main result of these traverses was to give me a splendid conception of the physical configuration of West Java, and that I was enabled to obtain satisfactory evidence of the extensive upheaval which Java has experienced in modern geological time. This I place at not less than 2000 feet, since all over West Java we find on the surface foraminiferous muds of Post-Tertiary or late Tertiary age extending up to the heights of 2000 feet.

Now, let us endeavour to picture for ourselves the appearance of what is now known as West Java before this upheaval began. Accepting the present surface-configuration as our guide, we at once perceive that at that modern geological time Java was twice as far from the present Sumatra as it is in our own day; but Sumatra, as its upraised modern formations show, must have also been similarly affected by this great upheaval, so that before the elevation began, the distance between the two was even greater than double the present width of the Sunda Strait. At that time, however, in the place of the continuous land at present

forming West Java, there was only a scattered archipelago of small islands. Bantam lay for the most part hundreds of feet beneath the sea, and only the peaks of Goenoeng Karang and Poeloe Sari, with those of the mountains in the south-east quarter of the Residency, appeared above the waves. There was but little then to be seen of the Residencies of Batavia and Krawang, and of the northern part of Cheribon. The great volcanic mountains of Gedeh, Salak, and Boerangrang then appeared as distinct islands, and in the Preanger Residency, Tjikorei, Papendaya, Patoeha, and several other peaks, formed irregular groups of small islands. At that time the adjacent southern end of Sumatra was similarly represented by a group of islands; and in truth this must have been the general condition of both Java and Sumatra.

Now since the effect of a movement of upheaval in an area of an archipelago is to increase the islands in size, and to unite them into larger islands, the evidence of upheaval in this region all goes to show that Java and Sumatra have never been united in the past, but that they probably will be joined together in the future. Zoological evidence is frequently adduced to prove the former connection of these two islands, but since it assumes the very connection we dispute, we must disregard it. The moment we begin to admit inferential evidence of this description, and do not deem it necessary to look for direct proofs of such a physical change, our imagination gets the mastery of our powers of reasoning. Straits are obliterated and islands submerged to explain the distribution of a species, and even a continent must disappear to account for the presence of a monkey. Nor have we any grounds for the tradition, lately noticed in the columns of *Nature*, that Java and Sumatra have been disrupted during some ancient eruption of Krakatoa. Can we point to any volcanic outburst that has sent into the air a tract of land fifty miles in width? And yet this is the work that ancient Krakatoa is believed to have been able to effect. There is no reason to doubt that the crater of Krakatoa may have been once three or four miles across, and that it has blown itself to fragments more than once in the course of its history; but surely the greater part of the débris of such vast explosions would fall in and around the Sunda Strait; and it therefore becomes apparent that this very volcano has been doing its best in the past, as well as in the present, to complete the union of Java and Sumatra by filling up the strait between them with its ejected materials. It is to the constructive action of volcanoes that many large islands, such as Java, owe mainly their size and height. If volcanoes have such destructive effects as are attributed to Krakatoa, it is difficult to conceive how an island of the extent of Java could have ever been formed, notwithstanding the great upheaval which has been here going on in later Tertiary and Post-Tertiary times. The two islands, it is true, are only about fourteen miles apart at the narrowest portion of the Strait; but opposite Krakatoa they are about fifty miles asunder. Mere proximity, however, by no means necessarily implies a former union between two large islands, especially when they are the scenes of volcanic action. They may have been approximated during a general movement of upheaval, or they may have been parted during a general movement

of subsidence. They may have been rudely severed by some vast explosion, or they may have been divided by a local subsidence, or their increasing areas may have approached each other by the constructive agency of volcanoes, or they may have been separated by marine erosion. Only the evidence obtained on the spot can give us a satisfactory answer.

If Krakatoa has performed the gigantic operation of blowing into the air a tract of land greater in area and greater in mass than the county of Cornwall, a proceeding on its part which is antecedently improbable, or if the Sunda Strait has been formed by a local, though extensive, subsidence, there would certainly be some appearance of broken continuity on the opposite sides of the strait separating these two islands. There is, however, no such appearance. If we look at the opposing coasts of Java and Sumatra (and the circumstance of being becalmed in the strait has given me the opportunity of doing so for days together) we observe no evidence in the independent contour and profile of each coast in support of the explanation that they were parted by a volcanic explosion or by a local subsidence. It is true, as Verbeek has shown, that ancient schistose rocks are exposed in some of the small islands in the narrowest parts of the strait, but these rocks were more probably exposed by marine and sub-aërial denudation during a period of upheaval, of which we have direct evidence, than by a volcanic explosion concerning which the locality affords no direct proof.[1] I have already pointed out that Java and Sumatra lie in an area of upheaval, and the explanation of a general subsidence of this region is at once excluded. We are therefore led to the conclusion that these two large islands owe their proximity mainly to a general movement of upheaval. It is of course possible that they may have been temporarily united, where the strait is now narrowest, during this upheaval; and that they have been separated since by marine erosion; but there is no direct evidence on this point.

The story of the low plains of Bantam, which I have already briefly described, is very suggestive. Not long ago, geologically speaking, they were hundreds of feet under the sea. Then they were upheaved, and during a lengthened period, following the emergence of the plains and their subsequent clothing with forest, the Bantam volcanoes belched out enormous quantities of dust and ashes, that overwhelmed the forests which are now represented by the imbedded trunks of silicified trees exposed in numbers in every road-cutting in Central Bantam. The emergence of Bantam brought the west end of Java close to Sumatra, adding to its length another thirty miles or more. At the same time the nearest point of Sumatra rose above the waters, and its land-surface was increased by the eruptions of the volcano of Radja-Bassa. Thus the proximity of these two large islands may be explained by a general upheaval assisted by volcanic eruptions.

[1] These schistose rocks, according to Verbeek, are also represented in Java. I found rocks apparently of this character exposed at one place on the Bantam coast between Pangerangan and Tjiara.

THE ISLAND OF KADAVU.

(With a Map.)

By J. P. Thomson, F.R.S.G.S., etc.,

Hon. Secretary and Treasurer of the R.G.S.A., Brisbane.

The island of Kadavu, which constitutes the most southerly inhabited portion of the Fiji group of islands, situated in the South Pacific Ocean, is bounded between the parallels of 18° 55′ and 19° 10′ south latitude, and 177° 57′ and 178° 30′ east longitude; its aggregate length is therefore about 33 miles, its greatest breadth about $7\frac{3}{4}$ miles, and its area about 131 square miles. Some fifteen years ago Kadavu, chiefly owing to its geographical position and the natural advantages it afforded, was considered an island of very great importance, as it is conveniently situated, and easily accessible to the great ocean highway between Australia and San Francisco, and formerly used by the steamers trading between these respective places as a port of call. It is therefore, irrespective of its natural capabilities, its peculiar and singular features, and its inhabitants, of considerable historical renown, and worthy of a place in the annals of geographical research. An admiration of its natural beauty, and a keen interest and belief in its future prosperity, if its natural resources are properly utilised, prompts me to place on record a detailed description, from personal observation obtained by my official survey and exploration of the island during the year 1884.

The island itself is almost entirely composed of an irregular and broken mountain chain, which extends in a SW. and NE. direction to the extreme ends of the island, and in many places its offshoots and escarpments on the NW. and SE. terminate in steep and rugged gradients to the very water's edge, where the seething billows of the ocean dash their silvery spray far above the level of its bosom. These escarpments are in places distorted by deep fissures, forming rifts and rills, in some respects somewhat resembling modified lunar landscapes. The anticlinal axes of the ridges formed by these distortions are usually occupied by huge masses of conglomerate and boulders of various shapes and of many sizes, ranging from that of the minimum to the maximum. These are evidently ejecta from craters of a bygone period, now extinct. These boulders, which are scattered over the whole of the island, exhibit indications of having passed through stages of change subject to the influence and control of the erosive action of water and atmospheric agency, while marine characteristics exhibit themselves in many of the conglomerate masses, even in those located on the crown of the ranges, also on the slopes of the mountains, notwithstanding their very considerable altitude, and their rugged and precipitous character. By reason of their steep declivity, no heavy deposits of soil can form on some of the mountains and leading ridges, by which cause the surface-soil crust is of no useful depth; this characteristic is especially developed on surfaces denuded of timber and scrub, and covered only with long coarse grass, surface-creeping vines, tall reeds, and, in some places, small patches

of bracken. On surfaces covered with timber, even on the highest mountains, the soil is of far greater depth, and possesses higher productive substances; here we are furnished with an illustration of the complexity of cause and effect, inasmuch as the product actually becomes the producer, as, forsooth, the trees and shrubs by their offshoots and close proximity to one another retain, while the augmentation and decay of vegetable deposit annually increase and nurture, the soil. This diversification of forest and vegetation produces a pleasant and picturesque effect by their variegated contrast, and the light reeds and grasses, in blending their beautiful bright colours, infuse their surroundings with rich and rare tints of shade, which lend brightness to the sombre aspect of the dense forest and jungle; this especially applies to the north-west or lee half of the island. Although many features on Kadavu proper point to its prehistoric condition, to its eruptive or seismic origin, such as the existence of distributed igneous rocks, extinct craters, etc., yet the small island of Ono, adjacent to its northern shores, and separated therefrom only by a narrow strait, perhaps possesses the more recent and marked traces, as the island itself is practically a volcanic cone, containing on its north-eastern section one of the largest and most recent extinct craters in the group; its exterior wall faces the ocean, and towering several hundred feet above the base, culminates in a rugged and precipitous razor-backed rim, which in several places is practically inaccessible, and accessible points are at places dangerous owing to the scoriaceous formation, which makes a foot-hold insecure. When carrying out a survey in its neighbourhood, triangulation of the crater walls was necessary, as measurements by the steel-band were altogether impracticable. The external walls are in several places almost entirely denuded of vegetation, and where occurring, it consists wholly of dry bracken and coarse grass, neither of which constitute food for domestic animals, excepting during the dry season for goats, which appear to favour the locality. Internally some short grass of a palatable nature, also numerous stunted trees appear to flourish, although by no means luxuriantly. They, however, afford a relief to the dry, barren-looking, brown, external surroundings. The most prominent feature in the main Kadavu Range is at Tavuki Isthmus, where it is actually cleft in two, leaving the island so narrow and the surface of the ground so low that during stormy weather the sea washes right across from either side. This natural conformation, which the natives call Yarabali, is however largely utilised by natives and Europeans, who drag their canoes and boats across from one side of the island to the other; the task is a comparatively easy one, as the seasoned stems of the leaves of the coco-nut palms, which are smooth and fibrous, are always kept lying transversely on the track, so that once a vessel is placed upon them it is easily dragged along. Thus we are provided with a primitive, although very natural, means, which to native and European alike is a great boon, of transporting ships across the island of Kadavu. An inspection of the map will clearly show the great advantage afforded to maritime enterprise by this overland passage. On the south side of Tavuki Isthmus is situated the island of Galoa, a small but very fertile island, which was used as a head depôt during the years of 1873-74, and

1875-77, when the San Francisco mail steamers made Galoa Harbour their Fijian port of call. The first steamer arrived at Galoa on December 25, 1873, and continued to call for a period of ten months, at which time the Company failed. During an interval of over a year Galoa was almost deserted, until the second line of steamers began to call in November 1875, and continued without intermission to May 1877. On the south end of the island of Galoa, and inshore on the mainland of Kadavu, there are two beacons, used at one time to guide the mariner to a safe anchorage; other traces of bygone civilisation are still to be seen, such as storehouses constructed of sawn timber and painted white, etc. In those days the village of Wailevu, situated immediately inshore, presented all the indications of the attractiveness of life of a favourite watering-place. People from all parts of the group used to wait here for the mail steamer, and on her arrival passengers would land at the village and make short excursions in the interior, while others would wait the arrival of vessels to transport them to other parts of the group; but now, alas! the glory of Wailevu has departed, the long rank grass and vine hide the ruins of former dwellings, the once flourishing flower-beds give place to the weeds, the uncultivated fruit-trees yield their increase to the birds of the air, and only for the presence of Mr. Simpson, a native trader, and his European wife, desolation would everywhere appear. I doubt whether Wailevu will ever resume its former vitality, as the removal of the capital from Levuka to Suva places the latter place in a most favourable position as the most convenient port of call for any line of ocean-going steamers trading between the Australasian continent and San Francisco or any part of Europe, apart from its importance as the chief port of entry of the group; unless indeed the high lands of Kadavu are utilised as the sanatorium of Fiji, for which they are well suited, in the event of which Wailevu would doubtless command the largest share of patronage. I shall now proceed to describe the physical features of the island.

As before stated, nearly all of Kadavu is occupied by the main watershed range and its offshoots, which are very much disintegrated, so that the whole interior of the island assumes a somewhat distorted appearance. The slopes and sides of the mountains and ranges are cut up and disfigured by deep, and in some instances broad fissures and ravines, the sides of which are in many places precipitous and rugged, which condition, in conjunction with the large masses of decapitated and disintegrated rocks, small boulders, and stones which are nearly everywhere scattered over the surface render the ascent of the mountain faces tedious and difficult. The principal mountains and leading heights of the island are Mount Washington (Bukù Levu) 2750 feet above sea-level, situated at the extreme SW. end; it acts as a most prominent landmark, and its top, which is nearly always enshrouded in dense vapour, is the first land in the group sighted by vessels approaching Fiji from the southward. It is covered with timber, reeds, and dense scrub, from its base to the summit. The timber and shrubs on the top of the mountain are very much scattered and dwarfed, and exhibit no indication of the powerful development so prominently shown in the timber and vegetation growing on the lower slopes, and the surface of the summit is so boggy

that a traveller will sink to the knees, a predominating feature characteristic of all the leading heights of the island. The exposed position of the summit renders all vegetation subject to almost perpetual envelopment in dense, cool, moist columns of vapour, and to the fury of all the high winds peculiar to the Western Pacific, which divest the trees and shrubs of their foliage, which, falling upon the surface of the ground in large quantities, become decomposed. The decomposed mass, being almost entirely excluded from the action of the sun's rays, is in a continual state of fermentation; the gases produced thereby accumulate much faster than the conditions of the atmosphere permit it to evaporate, and the substratum is almost impervious, so that the moisture from the decomposed mass of vegetable matter and the rain water have no rapid means of escape, which conditions, combined with the foregoing, are sufficient to satisfactorily account for the boggy nature of the surface. Easterly and north-easterly from Mount Washington the next heights, leading in consecutive order, are represented by Korotusara, 1610 ft., Mount Moala, 1643 ft., Mount Creak, 1140 ft., Asses' Ears, 1600 ft., Mount Challenger, 2180 ft., Mounts Yale and Korolevu, 1820 ft. The whole of the watershed range is in Fijian parlance designated Salevu-ni-Yalo, so named from spiritualistic belief; Yalo or Yalodra, spirit. According to the Fijian's belief in their idolatrous days, and I firmly believe up to this present date (1889), the spirits of the deceased when departed from the natural body were supposed to follow this range to its terminal point called Naigoro, at the extreme eastern end of the island, and from thence depart to their eternal home some place outside the limits of our terraqueous globe or to the river Styx. There are no rivers in the island, the rain and natural waters are drained by numerous creeks, some of which are tidal and sufficiently deep enough to float ordinary sailing boats. The coast line of Kadavu, which on all sides of the island is very broken and rugged, is on its south-east section protected from the heavy billows of the Pacific Ocean by a wall of coral extending from Tobanidavigele at the extreme south-west end of the island to D'Urville Channel, seventeen miles north from its north-east end, and called the Great Astrolabe Reef. In several places the proximity of this reef to the coast line renders inshore navigation by steamers and ocean-going vessels impossible, and boat navigation, which can only be practically undertaken at or near high-water, intricate and in many places dangerous; this is particularly the case in the vicinity of Ucuna-garalevu, where the water is very shallow and the careering tide, which resembles the rapids of a great river, dash inshore with angry fury and washes the rocks on the beach. The passes of Davigele, Yauravu, Galoa, Soso, Korolevu, and Naigoro in the Great Barrier Reef, however, afforded ample facilities for coastal navigation. The north-west coast of the island, although possessing the natural advantage of shelter from the prevailing south-east winds, is, however, less favourably circumstanced than the one just described with regard to protection from heavy seas, as in the absence of the Great Barrier Reef the coast is studded with a perfect labyrinth of detached coral patches which, although in places close enough to one another to obstruct free navigation, are not sufficiently united to be of any practical

utility as a breakwater. As before mentioned, about two miles north from the north-east end of Kadavu is situated the small island of Ono, which, like the former, is a series of hills culminating in the centre of the island to an altitude of 1160 feet. Although the soil on Ono is very rich and dry, yet there is no timber on its surface excepting small patches of stunted scrub trees. The whole of its surface is covered with large and small stone boulders which render walking very obstructive and tedious.

Soil.—The soil of Kadavu, although generally similar in substance to that of the other islands of the group, is somewhat different in distribution. The flat lands on the south-west section of the island are limited to small patches at the mouths of narrow valleys and to narrow strips between the base of the mountain ranges and the sea-shore; these are composed of rich *débris* robbed from the mountain slopes by the annual tropical rains with which the whole of the group is so copiously supplied; the slightly tenacious nature of the crust on the mountain slopes, however, as compared with other parts of the group, renders it in a small degree somewhat impervious to heavy rain, and consequently the annual percentage of soil dislodged is largely minimised by local conditions. Portions of the available flats are utilised by the natives for banana, yam, coco-nut, sugar, and vegetable planting for their domestic wants, and the residue, although in every respect equal, and in many places superior to that cultivated, yields its substance to the nourishment of wild rank grass, shrubs, reeds, and other tropical vegetation, which, in Kadavu, in common with the adjacent islands, grow in profuse luxuriance. Here the wild flowering plants are in perpetual blossom, and the scarlet Hibiscus, after quaffing the refreshing nectar of heaven's nightly dew, rears its drooping dead heavenwards in the early morn, and, as if it were performing an act of profound devotion, unfolds its broad deep red-tinted petals to the rising sun to inhale fresh vigour from its life-giving rays. Shady groves and nooks are carpeted with the falling leaves of trees and the decayed flowers of the uncultivated shrubs, and their combined perfumes are so infused with the atmosphere that its inhalation produces an intoxicating influence over all sensitive individuals subject to its magic spell. Here we may stand face to face with nature and behold all her wealth of beauty transfused into one another, and as we wonder at all the simplicity of the beautiful graces with which all her handiwork is adorned, we may also observe the unfolding, as it were, of all the complex functions of living organisms exhibited in the luxuriance of her verdure. The soil contained in the north-east section of the island varies slightly in quality from, and is somewhat differently distributed to that just described. The greatest extent of flat land is at Lawaki, Waiselima, and Korolevu at the extreme end of the island; the soil of these localities, although only comprised within flats of a very limited extent, is of a rich compound of alluvium *débris* containing a large percentage of phosphates, and highly suitable for the production of marvellous crops of all kinds of tropical and semi-tropical produce, as evidenced by an analysis of the soil itself, and indelibly proved by an inspection of the native plantations.

The south-east slopes, which are entirely unutilised, are crusted with a marvellously rich prolific soil annually enriched by the profuse decaying vegetation and the deposits of moist vapour intercepted by the high background ranges. All along the sea-shore on both sides of the island, at the heads of the numerous bays and inlets, especially between Qaralevu and Matasa, there are numerous patches of flat land composed of the *débris* carried down by the agency of water from the high lands; these flats are mostly used by the native population for their villages and plantations, and they are also generally planted with flourishing groves of the beautiful coco-nut palm, of which more anon. In accordance with unalterable and well-known natural laws, also in harmonious accord with the conditions existing throughout the group, the south-east slopes of Kadavu are more productive of vegetation than the opposite or sheltered side, although it is not everywhere uniform, as may easily be understood through the irregular distribution of the soil. There are altogether about forty European land claims in Kadavu, containing areas varying from 1 acre to 400 acres; but, unfortunately, out of the whole of the claimants there are only three who make the island their home, namely,—Messrs. Simpson, a trader, Blacklock, boat-builder, and Sassen, also a boat-builder and trader, all three of whom are very old residents of Kadavu.[1] This minimum European population is a source for much regret, as the natural and artificial capabilities of the island are not made use of, progress in commerce and agriculture is stagnated, many broad acres of the most fertile land, which could make many poor families happy and afford prosperous and flourishing homes for many, are waste and desolate, and social progress, if not altogether degenerative, is greatly retarded.

Flora.—Of all fruit-bearing palms and trees the coco-nut palm is, in my opinion, pre-eminent to all others; its utility is unrivalled, and probably unlimited. On comparatively barren rocky islets and on treacherous low-lying shores its distinctive, majestic head towering over, and so markedly and unmistakably dissimilar to all other vegetation, is a beacon to the mariner; in torrid climes, where it attains the zenith of its glory, it is unsurpassed by all other landmarks, and on many a lonely spot faithfully and well warns the sea-king of dangerous shores. The fibrous and tenacious nature of its timber renders it celebrated for special purposes in the building of native ships of war, houses, etc., while its other component parts, the feather-like leaves for mats, thatch, baskets, sails, etc., the core of the palm for salad, the fibre of the husk for ropes, mats, nails, etc., and the nut itself for food, drink, milk, toddy, oil, spoons, bowls, and other utensils, etc., are renowned. In consideration of the importance of the foregoing conditions, also with a view to instruct many who never have and probably never will see the palm, also those who have seen and learned not, I propose to give a detailed description of this graceful and truly wonderful palm.

Some writers appear to doubt the possibility of a self-planted coco-nut palm, but, to me, the question of possibility or probability has never

[1] A Wesleyan Missionary also resides on the island.

for one moment caused a conflicting thought; from personal observation, apart from consideration of the natural laws affecting the germ of plant life, I have no hesitation in saying that, under favourable and congenial conditions of clime and soil, the coco-nut will, unaided, save by natural process, take firm hold of the soil and develop into a graceful palm. Those familiar with the natural conditions of the coco-nut palm, and who are also original thinkers, accustomed to form conclusions from truly logical reasoning, and to accept deductions from a true reconciliation of cause and effect, cannot doubt my authority. The coco-nut palm springs from the germination of a vital substance contained within the strong walls of a large spherical nut-shell composed of an exceedingly hard combustible substance brought about by the consolidation of certain fibre-yielding substances, produced by the development of the nut. This shell is covered with a thick husk of strong fibre, and the whole intact nut, of which there are at least six different varieties in the Western Pacific, all slightly dissimilar from one another, and all which are not by any means triangular in shape as described in the *Encyclopædia Britannica*, when placed either by hand or by accident on the surface of, or some inches below, fertile soil, shoots out numerous roots from the husk, and the seed germinates from within, forcing a long thin sprout of leaf through the fibrous casing; the whole embryo thus conceived continues, like all the first beginnings of nature, to develop, until after the lapse of many years the graceful head of the palm is raised far above the surface. The coco-nut palm, which is slow in developing, yields its first crop of fully developed nuts about the seventh year of its age, and continues from that period of its existence to ripe old age to yield a yearly increase. In some favourable localities some varieties of coco-nut palms will bear fruit in the fifth and sixth years of their age, but in every such case brought under my notice the nuts were imperfectly developed.

During the first season of the year the shell of the nut, which at this stage is of a whitish colour, is thin and somewhat flexible, and contains about a pint measure of the most delicious liquid, in colour somewhat resembling ginger-beer, of a slightly sweetish and most agreeable and satisfying taste, peculiar to itself—erroneously called milk,—its interior walls are lined with a whitish fleshy substance, first formed by the cohesion of glutinous matter to the walls, quite thin, tenacious, and soft enough to be easily removed from the shell by the application of a slight pressure of the thumb, or by an ordinary dessert spoon; it is only when at this particular stage of development that the liquid is perfect and wholesome to drink, and the kernel nutritious and palatable for man to eat. From this stage, when the shell has obtained its maximum internal capacity, the kernel gradually consolidates, and growing rapidly in thickness, absorbs the encompassed liquid, which rapidly changes into a slightly tarty consistency, with a tendency to effervescence—it is only when at this particular stage that an over indulgence will probably produce an irritating effect on the urinary organs—and gradually diminishing in quantity eventually becomes altogether absorbed, leaving only a small, round, yellowish spongy substance about the size of a hen's egg. At this stage the whole sap contained in

the external husk has altogether disappeared, leaving only the dry fibre, which gives the nut an appearance of old age, such as may be seen in market places, and on board homeward-bound ships from tropical countries; the kernel has attained its greatest possible development, and is white, thick, hard, and ridgy—the coco-nut of commerce as sold by confectioners and street-vendors in Great Britain and elsewhere. It is from the fully or partially matured kernel that the real coco-nut milk is obtained. The natives grate the kernel into a coarse powder by means of a rectangular dentrictic piece of iron fixed into the end of a bar of wood, which rests on a fulcrum, and kept firmly in position by the weight of the operator, who, with a half of the coco-nut shell, containing half the kernel, placed in the palm of his hand, and the scraper projecting from his fork, grates up the whole of the kernel. After this primitive operation, the powder is sprinkled over with water, and a large, smooth, spherical red-hot stone is laid on and rolled over the whole mass, which, being promptly and dexterously strained, yields the true milk of the coco-nut. This milk is white, about the same consistency as cream, and containing a percentage of oily matter; it is agreeably sweet, and is commonly used with porridge; I have also used it with tea and coffee, and have found it to answer as a very good substitute for cow's milk. The kernel, when thus fully matured, is also removed from the shell, cut up into three or four pieces, dried on a "bather" in the sun, and exported as copra, at the rate of about from £10 per ton, from which the famous coco-nut oil is extracted. The period of drying, which of course is regulated by the condition of the atmosphere, occupies about three or four days, at the end of which time the kernel has lost about half its original weight. Each tree yields about 150 nuts annually, of which 4000 are required to make a ton of copra. The shell, which makes good fuel, is used for drinking-vessels and for culinary purposes. The fibre of the husk, known as coir, is used by the natives for an almost unlimited variety of purposes, and with Europeans its uses are of course well known. The wood of the palm, being fibrous, is, when newly cut, quite flexible; it is justly prized by the Fijians, who use it for the woodwork of their houses, and for numerous other purposes.

The bread-fruit is grown abundantly in Kadavu, on the fertile flats skirting the sea-shore; also in the valleys the tree flourishes, and the fruit attains its greatest degree of development. Apart from its food-producing qualities, the tree possesses many properties of economic value; it yields a glutinous substance of a somewhat light colour, which, upon exposure to the atmosphere, consolidates, and assumes such powerful tenacious properties that the application of its substance is largely used for the cementing of the planks of canoes and other vessels requiring the application of a binding substance. The inner casing-leaves of the pods are also used as a substitute for fine sand-paper, especially in polishing trinkets made of the tortoise-shell, for which use it is justly valued. The fruit of the tree is cooked, either by boiling, roasting, or by baking in the earthen and stone oven, and afterwards prepared in various ways for food, being sometimes pounded up with the coco-nut milk made into a delicious pudding, and otherwise eaten in its pure state, either form of which is excellent.

Many varieties of esculents are grown and cultivated by the native lords of the soil. Of these, the taro (*Colocasia antiquorum*) of which there are two varieties, the wet and the dry, is said to possess the more powerful nutritious substances for human food. It is cooked by the same process as the bread-fruit, and eaten in similarly prepared forms. The leaf which, when fully developed, is amongst the most perfect in symmetry and beauty in the vegetable kingdom, also the most useful, is in shape somewhat after the form of the heart of a large animal; to the touch, and in external appearance, it resembles a velvety substance. It is utilised by the natives for drinking and water-carrying purposes, and for such uses it is much preferable to the manufactured European article. When boiled and mashed up with butter it forms one of the most wholesome and delicious table vegetables—spinage—it acts on the liver, and its periodical use will ensure perfect regularity of and act as a stimulant to the digestive organisation. I strongly recommend its use to dyspeptic subjects, and to new arrivals in the colony. Its native name is *dalo*. Tobacco and yagona (*Piper methysticum*) are cultivated, but excepting several varieties of bananas, the natives show no special desire to plant fruit; they appear quite content with nature's offerings. Several varieties of oranges, mangoes, custard-apples, lemons, limes, and pine-apples grow in a practically wild state. They might at one time have been planted, but their development and nourishment are now left entirely to nature's control and care amongst the opulence of her offspring in the wilds of the forest. The shady bowers of the forest glens are overhanging and adorned with the branches and foliage of the orange trees. Of these there are the very large granulated, coarse-grained, thick-skinned variety, about six inches in diameter, the bitter variety used for preserves, and several of the sweet-eating varieties, whose skins contain a superabundance of the usual oily substance peculiar to the skins of oranges, which in Fiji retards and prevents them from properly maturing. The surface of the ground is thickly covered with the fallen oranges, and the whole surrounding atmosphere infused with their delicious perfume, which appears to steal upon the senses, so that those subject to its influence are intoxicated with the enthralling gentle breezes of the forest recesses, and become lost in admiration of nature's exhaustless wealth and munificence.

The ivi tree, or Polynesian chestnut (*Inocarpus edulis*) also flourishes in Kadavu, where its economic properties and umbrageous nature are rightly prized. It is when exposed to the fierce rays of the torrid sun that its cool shade is to white and black alike hailed with joy. The nut, which is enclosed in a hard, thick, strong, fibrous casing, is of an oval shape, and when boiled it is an agreeable and palatable food. In times when cultivated food is scarce, the natives are dependent largely upon the ivi nut for sustenance.

Crotons, hibiscus, several varieties of wild-flowers, and many ornamental shrubs grow in wild profusion over many parts of the island. The forest, although much scattered in patches, and inextensive in magnitude, produces the largest trees in the Fiji group, whose timbers, for local ship, boat, and house building purposes, are highly valued. Several

varieties are also well suited for cabinet-making purposes, especially the vesi (*Afzelia bijuga*) and dilo (*Calophyllum inophyllum*). Their timbers are close-grained, and take a fine polish. For ship and boat building purposes the following timber trees are the best: dakua (*Dammara vitiensis*), vivi (*Serianthes myriadenia*), damanu (*Calophyllum burmanni*), also the vesi and the dilo.

Of domestic animals, there is the pig, the goat, the dog, and the cat; the feathered family is represented by the fowl, the turkey, and the duck, also several varieties of pigeons, parrots, hawks, owls, and a number of small birds of the most beautiful and brilliant plumage, abound in the shades of the forest. Beautiful butterflies, moths, beetles, flies, and numerous other insects of various shapes, shades, and sizes, are at home in the cover of the island verdure. The rat and flying-fox are perhaps the only animals indigenous to Fiji. The small number of snakes inhabiting the branches of the forest trees are of a non-venomous kind; they are small in size, and at all times appear in a torpid state.

Fresh-water prawns and eels are plentiful in the creeks, and several varieties of land-crabs are common; the sea-shore and reefs abound in shell-fish of various descriptions, and plentiful supplies of scaled fishes are caught by nets in the shallow waters of the barrier and fringing reefs. Tortoises are also caught, their flesh eaten by the native aristocracy, and their shell used for ornamental and commercial purposes.

Natives.—The native population of Kadavu numbers about 7500, who live in separate towns or villages, in different districts. According to constitutional laws and usages, each district is subject to its deputy chief, called Buli, and surnamed after the district to which he belongs, who again in turn is responsible to the provincial chief, whose official title is Roko, and who, as recognised head, is their official representative to the State, also their hereditary representative in the native Parliament. This Roko, who is only appointed by the Crown, receives a salary from the State, and is allowed an official secretary, who is designated Vunivola. The reigning Roko, who is far advanced in years, is without teeth, and quite blind. When enjoying the hospitality of his court nothing used to delight me more than waiting upon him in the morning with a cup of coffee, and even holding the cup to his mouth; and I am almost sure our affection was mutual. He was kind and obliging, and possessed all the qualities of a noble mind and of a good ruler, with gentleness in his manner, and resolution in all his actions. His native name is Qarani-Valu, literally interpreted Cave-of-war, a name which in every respect appears from his early history to have been quite applicable, as he possesses a giant frame, and the history of his early exploits in warfare is quite thrilling, even to the modern mind. The natives of Kadavu are, in common with their neighbours of the adjacent islands, a physically strong and healthy people, a few suffer from ophthalmia, ringworm, and elephantiasis, and a few cases of phthisis may occasionally be met with, but this is by no means common. They are somewhat light in colour, with immense broad chests, fine arms, and beautifully formed limbs, bright eyes, and although generally somewhat broad, the features are

often intelligent. They are, as a rule, vivacious, kind, obliging, courteous, and hospitable. They are not over-sensitive subjects, consequently slow to take offence, and so, unlike their European brethren, they rarely lose mental control; this latter characteristic is a distinctive feature in their temperament. In social discussions, at State and public assemblages, and at legal tribunals, they exhibit superior tact to the average European by their cool and collected utterances. The plebeian and the king are alike gifted in oratory, stammering and stuttering in public speech are unknown to them, they are born elocutionists and accomplished rhetoricians; their reasoning faculties are moderately good, and their social organs are generally most harmoniously arranged; they have keen perceptive faculties, and are good at natural design; they are good at imitation, remarkably clever caricaturists, and natural cynics. They laugh at their white-skinned brethren for their characteristic accomplishments, which have become proverbial, in readily losing mental control. When in that condition they are dubbed "fools." They have a keen sense of justice, and discourage acts of dishonour; they are keen traders, and like to obtain full value for their goods. Charity in its pure and broader aspect, when uncontaminated by European intercourse, reigns in its natural state in their midst, and with them it begins at home. Hospitality is one of the characteristics of the Kadavu natives: it makes itself felt, and extends in every direction; in their villages, amongst themselves, to neighbouring villages, to strangers of their own class, and to all classes and conditions of Europeans the frugal board of hospitality is freely spread. Tardiness with food is absolutely foreign to their nature, one of their chief aims in life is to provide an abundant supply of food for their wants, and, as they give liberally to others, so, too, they expect, when required, liberality in return. The nature of my official duties necessitated an almost continuous intercourse with the natives of Kadavu and other parts of Fiji. I have camped for many months continuously in their midst; I have for years eaten of their products; it is therefore with much assurance and the fullest confidence that I pronounce them amongst the most hospitable, liberal, and charitable race of people upon the earth. European hospitality and charity at any time is mythical, but when placed in contrast with that of the Fijian it sinks into insignificance.

Petty quarrelling, jealousy, division, and dissension are uncommon to them; they religiously observe their social laws and usages, and the slightest infringement thereof ensures prompt and adequate punishment to the offender. Under the old native tribal *régime* the punishment usually inflicted upon delinquents was torture, degradation, and death.

They are a servile people, and loyalty to their chief is a prevailing feature in their character; in all things, and at all times, his commands are law, and formerly the sacrifice of life in their execution was considered honourable and heroic. Human sacrifice on State and festive occasions was one of the clauses in their social code. Whenever the death of a chief or prince occurred, young and handsome women, gaily attired in gorgeous native robes, would voluntarily present themselves at the obsequies, and demand to be buried alive, as an illustration of devotion to the departed one. Likewise, at the building of a chief's or other

important house, when the pit was dug ready to receive the central supporting pillar of the house, two or three men also gaily attired would deliberately jump into it, and with due solemnity allow the pillar to be lowered, and the earth filled in upon their living forms; this, with the launching of war-canoes over the prostrate bodies of living men, was a common, and to them necessary, method of human sacrifice. Strangulation of the sick and maimed was formerly the customary practice amongst the Kadavu tribe. Although far behind the times in modern advancement, they were nevertheless several steps ahead of it in logical ideas, as they practically believed in the survival of the fittest.

Based upon and in accordance with natural laws, their social organisations are elaborate and apparently perfect; it is when attempting to incorporate the native social and moral laws with that of a foreign civilised nation that friction and complications arise. Left in the enjoyment of their social usages and rights, the natives of a country will thrive; take that away from them, and make them amenable and subservient to that of civilisation, and they will surely degenerate. They possess a parliament and a court of law, both of which are presided over by ministers and magistrates of their own class, before whom all disputes and grievances must be dealt with. They have a jail in the capital, and every village possesses its officer of the law in the person of police-constable, the number of each village being proportional to its population. They have churches, state and mission schools in charge of native teachers, where the youths receive education and religious instruction. They hold devotional service on Sundays and on some of the week-days, and never neglect evening and occasionally have morning prayers in their houses; the former is usually offered just before retiring for the night; they pray apparently earnestly and aloud, with marvellous fluency. In the native teacher's house the evening and morning prayers are usually preceded by the singing of a hymn or psalm, the incantation of which sounds most melodious from a short distance. Music is taught in the schools, more especially in those attached to the Roman Catholic mission stations, and presided over by those devoted self-sacrificing and learned French priests, of which the stations situated at Levuka and Bureta, Ovalau, supply worthy representatives.

No companionship appears to exist betwixt man and wife; she is generally the slave of her lord, and apparently she has no ambition to improve her state. Her work usually consists of fishing, mat, cloth, and pottery making, plantation weeding, the procuring of firewood, the carrying, cooking, and serving of food, the whole of the household duties, the dramatic entertainment of the men, and numerous other minor and auxiliary labours. The young women are pleasant, graceful, kind, vivacious, and possess many natural endearing charms, and imperfect development is of rare occurrence amongst them. Maidens are always readily distinguished by a few long narrow plaits of hair hanging down the side of their heads. When they become wives these maidenly ornaments are cut off. They marry according to English marriage law, and the application of the law of divorce is as rare as it is novel. Infidelity and immoral practices are extremely rare amongst the female

section of the Kadavu community; in this respect their characters are truly worthy of emulation. Their dwelling-houses, which are neatly built of timber, reeds, and thatch, are sometimes beautifully ornamented internally with designs wrought in coloured sennit made from the cocoanut fibre; the floors are covered with beautifully wrought mats, and when well built and finished a Fijian house is the most cool and comfortable that can be constructed to meet the requirements of a tropical climate. The larger and more important houses are built upon foundations of from 2 ft. to 10 ft. in height, constructed of stone and coral, and are usually approached at the main entrance by means of a massive plank of hard wood placed at an angle, the inclination of which is governed by the height of the foundation, and the length of itself, with footsteps hewn out of the solid wood. This plank, needless to say, is more easily traversed by the barefooted natives than by the booted whites. Houses of this class are usually thatched on the roof with the leaf of the sugar-cane, which lasts for many years, and whose durability is unsurpassed for this special purpose. The interior front section is occupied by one or more square fire-places, and the extreme end by an elevated daïs composed of dried vegetation, and covered with mats, the whole imposing structure forming a huge bed, the height and area of which depend upon the importance of its owner. The Kadavuans are thorough practical agriculturists, and their importance as food-producers is fully recognised by all classes of colonists who are dependent almost altogether upon the yield of their harvest for vegetable food. They pay their taxes in kind, and their plantations produce, in addition to that required for their own use, sufficient for the consumption of a considerable export trade to European centres in different parts of the group. They plant tobacco, sugar-cane, maize, cotton, kava (*Piper methysticum*), yams, several varieties of sweet potatoes, pumpkins, arrowroot, beans, taro, etc. They are expert irrigationists, and its value in enriching and improving land has long been known to them. Their agricultural land may be divided into two classes: alluvium flats and hill-side slopes. Plantations on the former are in all cases bounded by natural boundaries, and subdivided artificially into sections of uniform areas representing individual shares. That these artificial division marks may consist of stones, mud-dykes, furrows, or stakes will altogether depend upon natural conditions and individual peculiarities. Natural boundaries are usually creeks and rivulets whose waters, being ever permanent, are conducted to the cultivated subdivisions by artificial channels and wooden troughs. Hill-side plantations are usually terraced and irrigated by the waters of neighbouring creeks gravitated thither, sometimes from considerable distances, through bamboos and artificial races. Although both classes of plantations show great agricultural method and skill, the latter presents greater artistic features, and when well executed it is somewhat picturesque. The utilisation of astronomy as handmaiden to agriculture was, even from the earliest ages of the colony, fully recognised; that the heavenly bodies were methodically observed by the Kadavuans is clearly exemplified by their application of stellar cyclic periods to the regulation of the seasons. Even now, notwithstanding the advantages of civilisation,

the times for sowing and for reaping are generally indicated by the apparent positions of the constellations, that of the Pleiades, *Vrusa;* Crucis, *Na Iri;* and Orion, *Na Ga*, being prominent.

Although cannibalism, practised within narrow and contracted limits, no doubt existed, its dramatic and awe-inspiring history, for which European missionaries are largely responsible, is obviously grossly exaggerated, and calculated to inflict grievous injury upon the natives and their possessions. Delinquents were sometimes punished by death. They were usually attired in fantastical native garments, bound hand and foot, and placed uncomfortably close to the edge of the oven (*lovo*) where they were compelled to watch the process of heating and preparing it for their reception. When the stones forming the lining of the oven became red-hot the unfortunate victims, who, during the process were almost scorched by the intensity of its heat, were dealt a terrible and fatal blow on the back of the head with a club and pitched into the yawning oven! The religion is Protestant and Roman Catholic, and, although apparently devout worshippers, I am, from close observation of actions and numerous confessions, constrained to believe they do not yet understand modern Christianity from the national standpoint; they listen attentively to the promulgation of religious doctrine, but they are unable to grasp its substance, and unwilling to believe scriptural texts.

Mr. W. L. Allardyce, who represents the Government as stipendiary magistrate and native tax-collector, pays periodical visits to the island. Mr. Allardyce is always ready to render personal assistance and supply information, and his services were sometimes valuable to me in recording the time when engaged conducting my astronomical observations, especially in my observation of the total eclipse of the moon on 10th April 1884, also those necessary for geodetic and trigonometrical operations; it is therefore with much pleasure that I associate his name with that interesting work.

Climate.—From a climatic point of view Kadavu occupies the enviable position of the Fiji group; its high lands and general physical conditions, combined with its geographical position, are favourable to moderate and uniform range of temperature, which combination of causes tends to produce favourable climatic effects conducive to healthy conditions in their various aspects. Considered as essentially tropical, the climate of Kadavu is almost perfect; tempered by the cool south-east trade-winds, from the beginning of April till the end of November the atmosphere is cool and enjoyable on the lower localities, while its condition on the high lands is manifestly cool, refreshing, and bracing. The climate is dry, and notwithstanding the usual periodical wet season so common in the tropics, that to which Kadavu is subjected is mild and of short duration. Thus it follows that the sum of the foregoing conditions, when combined with its beautiful, picturesque natural scenery, provides all the requirements necessary to render Kadavu congenial to the life and well-being of mankind. Other conditions being equal, I would scarcely wish a more charming place in which to pass my life. The absence of systematic meteorological observations for a useful and

reliable period preclude the supply of indicated measurements. In conclusion, may I be permitted to add, that if the many months of solitude and hardships, not unaccompanied by actual mental and physical pain, devoted to survey and scientific exploration in Kadavu, tend to promote the laudable objects of the Royal Scottish Geographical Society, in however small a degree, I shall consider my labours amply repaid.

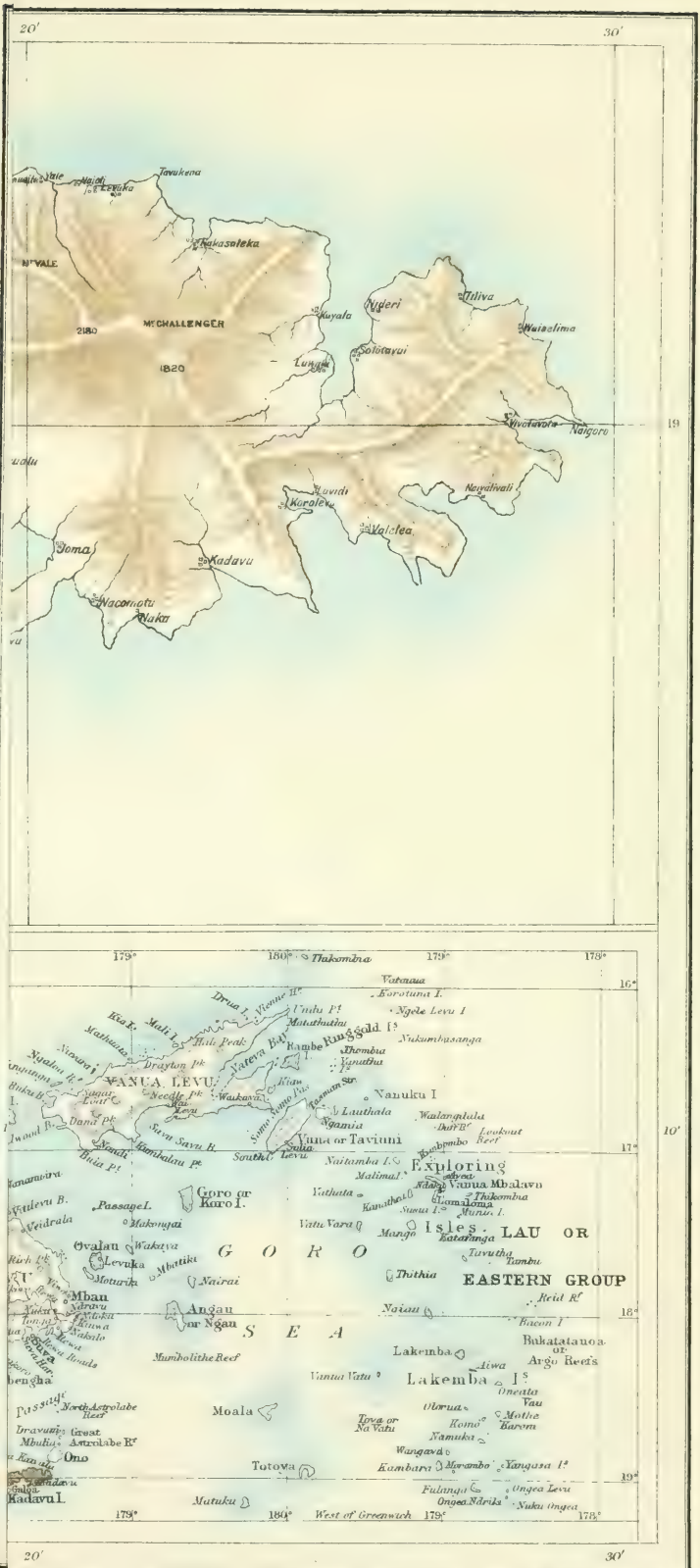
COMMERCIAL STATISTICS OF SARDINIA.

In respect of completeness and usefulness the publications of the Italian Statistical Office are scarcely surpassed by any works of a similar kind in Europe or America. And amongst those publications a place must be given in the very first rank to the volumes entitled *Annali di Statistica*, a series of short monographs on the industrial condition of different provinces of Italy. These little books, which do not suffer from an excess of elaboration, convey much serviceable knowledge, mostly statistical, arranged in a compact form, and couched in plain business-like language, which renders them in the highest degree not only useful as sources for reference to the student, but also to the merchant who desires to obtain a brief general account of the various local industries and occupations of the Italian provinces.

In this notice we make the reader acquainted with one of the volumes of these *Annali di Statistica*, which has recently come into our hands. It is entitled *Notizie sulle Condizioni Industriali dell' Isola di Sardegna*, and is dated 1887; that is, An Account of the Industrial Condition of the Island of Sardinia. The information contained in its pages is based almost exclusively upon official papers and reports, and, therefore, carries with it the best guarantee of accuracy and reliability. But, since Sardinia happens to be outside of the world's great lines of communication, and outside of the purview of the political problems of the day and the hour, it may not, perhaps, be amiss if, before proceeding to say anything about the industry and commerce of the island, we refresh the reader's memory with a few leading facts culled from its general statistics, which are likewise gleaned from the monograph before us.

The total area of Sardinia is set down as 9294 square miles; of these, 5255 square miles are contained in the province of Cagliari—that is, the southern division of the island—and 3921 in Sassari, the second and only other province, in the north, whilst the remaining few square miles (118) belong to the smaller islands round the coasts. The total population on 31st December 1881 was not more than 682,002. This gives a density of only 78·38 inhabitants per square mile. Sicily, which has a somewhat larger area (9936 square miles), has 2,927,901 inhabitants, or 294·67 to the square mile. The bulk of the population live in the southern province of Cagliari, namely, on 31st December 1881, 420,635, and this number is estimated to have increased to 440,149 by the end of 1886. On the other hand, Sassari had, in 1881, 261,367 inhabitants, who in 1886 were estimated at 276,745.

The deplorably low level at which education stands is proved by the



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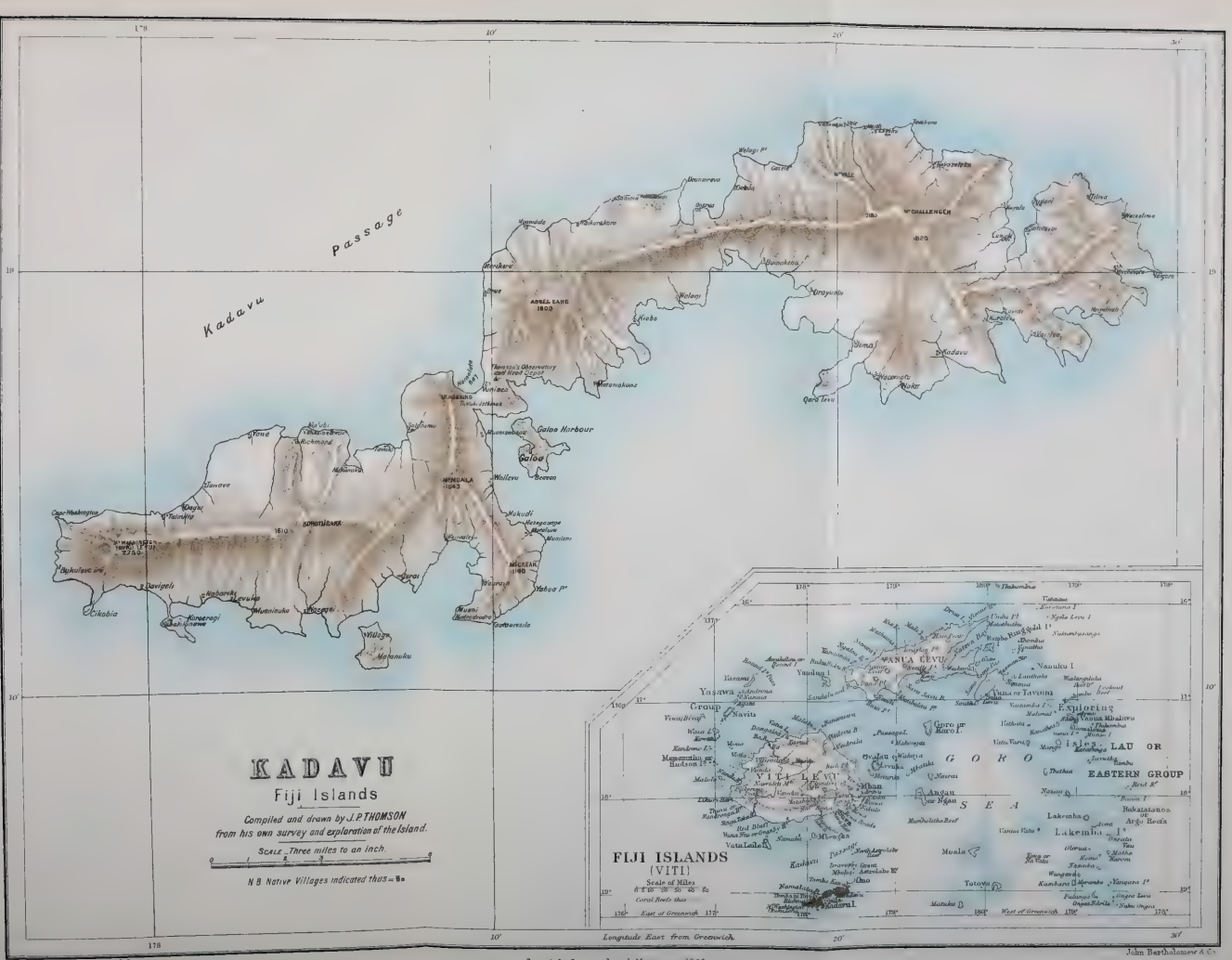

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fact that in 1881 the percentage of persons unable to read and write was, in the province of Cagliari, 82·09, and in that of Sassari, 76·12. And yet there are nearly 1300 primary schools, with twenty-two schools for higher instruction, and two universities, having their headquarters in the two provincial capitals. Both universities are, however, in a languishing condition; that of Cagliari had only 134 students in 1885, whilst at Sassari there were in the same year only 124.

Means of Communication.—In the beginning of the present century Sardinia possessed no roads that could be traversed by wheeled vehicles; and it was not till 1827 that the Government put its hand to the work of opening up means of communication in the island. To what extent its labours have been crowned with success will be apparent from the fact that at the end of 1887 there were 291 miles of railway actually constructed, and 2627 miles of ordinary roads, national, provincial, and communal. Along the ordinary roads the transport of goods generally takes place on carts drawn by oxen; horses and mules are also used to some extent as draught animals. As the rivers are mostly torrential in character, and, therefore, not suited for the transit of vessels, carriage of goods by water is confined almost exclusively to coastal and sea navigation, the greatest number of cargoes passing to and from Italy. In the year 1886 there entered at the different ports of the island 5967 vessels, having an aggregate burden of 1,186,787 tons, whilst in the same year there cleared 5917 vessels of 1,180,910 tons. About one-third of this commerce belongs to the port of Cagliari. Other means of communication, such as post-offices and telegraph-stations, exist in numbers fairly commensurate to the needs of the population: of the former, the island possessed 145 at the end of 1887, and of the latter, 105. Compared with his Italian compatriot on the mainland, each Sardinian sends and receives during the course of the year about one-half as many letters and post-cards, but rather more than half as many telegrams, as the former.

Thrift.—In thrift, as judged by the published statements of accounts of the savings banks and other banks of deposit, the Sardinians come a long way behind the Italians proper. Whereas in Italy, basing upon the census of 1881, the average amount of such savings that fell to each inhabitant was 56 lire, or £2, 1s. 2d., in Sardinia it is only 18½ lire, or 15s. 0½d. But in Sardinia itself there is a very striking difference observable in the saving habits of the people of the two provinces: in Cagliari each individual is entitled, on an average, to close upon 26 lire, or £1, 1s. 8d., but in Sassari to an average of barely 7 lire, or 5s. 2½d.

Occupations.—The wealth of the island is derived almost entirely from its raw products. Mining, agriculture, fishing, charcoal-burning, and a little—a very little—manufacturing industry constitute the chief occupations of the inhabitants. Manufactures on the large scale can, indeed, hardly be said to exist at all. Nevertheless in most parts of the island the people combine with their other occupations the spinning and weaving of various textiles (*see below*).

Mining.—This being the most important of the Sardinian industries is naturally entitled to the first place in a consideration of the wealth-giving resources of the island. The earliest people who worked the mines of Sardinia are said to have been the Phœnicians. More certain it is that the Carthaginians, during their occupation of the island (512 B.C.-238 B.C.), and after them the Romans, both conducted mining operations. After the fall of the Western Empire mining was discontinued, until it was again resumed under the Pisans, who were masters of the island from 1050 to 1403, and, subsequent to their expulsion by the Aragonese, it was continued by these latter. The discovery of America once more caused a suspension of mining in Sardinia; nor was the work prosecuted again until after the union of the island with the duchy of Savoy. The minerals principally extracted are lead and zinc, and in a secondary degree silver, antimony, manganese, and lignite. These are found almost exclusively in the south of the island; in the northern province of Sassari there was only one mine worked in 1884-85, yielding 270 tons of lead and 4300 of zinc, to the annual value of £15,480. In the province of Cagliari there were, however, during the same year fifty mines in all, from which were extracted minerals to the total value of £579,750. Of this amount £215,265 represent the value of the lead, £245,170 the value of the zinc, and £79,810 that of the silver. A comparatively small part of this raw metal is smelted in the island; in fact, in 1884-85 there were only two smelting-works in activity throughout Sardinia.

Besides the above-mentioned branches of the mining industry, a large quantity of salt is prepared for the market every year. The owner of all the sources of supply is the Government, which farms out the privilege to extract the salt and manufacture it. The average annual production amounts to about 150,000 tons, though in 1885-6 it rose to a total of 158,834 tons. Of this latter quantity 93,528 tons, valued at £42,867, were exported. Granite is quarried to the value of about £17,000 per annum, £12,500 being the value of stone cut in Cagliari, and £4500 that of stone extracted in the province of Sassari.

Agriculture.—The agriculture of the island cannot be said to be altogether in a flourishing condition. Scarcely more than one-fifth (20·25 per cent.) of the soil is cultivable in Cagliari province, and much less than one-fifth, namely, 18·07 per cent. only, in the province of Sassari. One principal cause of this unsatisfactory state of things is that extensive tracts of the island, especially in the south, consist of undrained marshy soil, so much subject to malaria as to be almost wholly uninhabitable. Laudable efforts are, however, now being made, both by the Government and by the private owners of land, to remedy this evil condition by the drainage of the malaria-stricken marsh-lands; 7800 acres have already been drained, whilst 32,600 acres more are about to have the same improvement effected for them—still leaving 24,547 acres to be drained at some subsequent time.

The subjoined figures will convey the best idea of the kind and

quantity of the principal agricultural products of the entire island, taking the averages for the period 1879-83 :—

Product.	Average Area Cultivated Annually.	Average Annual Production.
Wheat,	377,797 acres.	3,179,288 bushels.
Barley,	146,115 ,,	1,343,469 ,,
Beans,	55,105 ,,	404,814 ,,
Potatoes,	4,562 ,,	123,158 cwts.
Chestnuts,	6,927 ,,	65,505 ,,
Vine,	139,862 ,,	21,497,982 gals. of wine.
Olives,	38,095 ,,	1,467,356 gals. of oil.
Tobacco,[1]	782 ,,	575,731 lb.
Oranges, Lemons, etc.	—	29,412,881 no. of fruits.
Hay and Grass,	—	2,907,431 cwts.
Silkworm Cocoons,	—	39,490 lb.

The total value of all the agricultural products is set down at some £2,667,000 annually. To this must be added £237,073 more for cheese (982,946 cwts.), butter (2947 cwts.), and wool (908 tons). Of this latter class of produce more than one-half of the wool and all the butter are assigned to the province of Sassari, whilst two-thirds of the cheese is made in that of Cagliari. The Sardinian farmers possess of wealth in the shape of live stock some 279,500 cattle, 845,000 sheep, 261,600 goats, 60,500 pigs, 65,000 horses, and 22,200 asses and mules.

Forests.—The products of the forests, consisting of firewood, charcoal, bark, cork, acorns, etc., of which charcoal is by a long way the most important, are valued at the not inconsiderable figure of £283,074[2] every year, of which £174,529 represent the value of the forest products in Cagliari province. The total area of the island covered by forest is set down at 1,674,319 acres (994,432 in Cagliari and 679,887 acres in Sassari), or 28 per cent. of the total area.

Products of the Sea.—The fish that is principally caught is tunny, of which some 18,000 cwts. are sent every year to Italy, very largely to Leghorn and Genoa. But the coral fishing is of much greater importance, though it has very much declined from what it was ten years ago. The fishery lasts through the summer months, beginning in March and ending in October, and is mostly carried on to a distance of 12 to 15 miles from shore, in water that does not exceed 80 fathoms in depth. The vessels employed in the fishery are generally small, of about 10 to 15 tons burden, and carry crews of from 5 to 10 men. The decline in the fishery is due to a combination of causes, amongst which the most important seem to have been the gradual exhaustion of the Sardinian banks, the discovery of new banks (1875-80) off Sciacca, the inducements

[1] In the province of Sassari only.

[2] Based upon returns for 1883 in the case of Cagliari, and upon the average of the years 1879-83 for Sassari.

offered by the French Government to the Sardinian coral-fishers to go and prosecute their calling off the coasts of Algeria, and finally some change in fashion and taste on the part of those who were accustomed to purchase and wear coral ornaments. In 1881 there were engaged in this occupation in Sardinian waters 93 vessels, manned by a total of 558 men, and they harvested altogether 5612 lb. of coral, valued at £12,506. In 1883 there were only 82 vessels, with 492 men, who gathered 2033 lb., valued at £3739. But in 1886 the figures had gone still lower, namely to 31 vessels, manned by 60 men, their return being 432 lb. of coral, valued at £1042. From these figures it will also be seen that, concomitantly with the diminution in the quantity collected, there has also been a slight decline in the price.

Industries.—The industries of the island are not of much moment, apart from the spinning carried on in the households by the women, who make their own and the men's clothing and other textiles they require for domestic use. The materials with which they principally work are wool, flax, hemp, and cotton, in the order named. Setting aside these domestic industries, when we have said that annually some 23,260 tons of corn are ground, some 21,000 cwts. of macaroni made, 17,570 gals. of spirits distilled, 43,330 gals. of aërated water made, and 629,500 lb. of tobacco and cigars (valued at £109,910) manufactured, we have said nearly all that can be embraced under the heading of Sardinian industries. The only exception to this statement is that the tanning of hides and the preparation of leather seem to give occupation to a considerable number of men. In the province of Cagliari, 7950 cwts. of leather, estimated to be worth £78,350, are prepared every year; and in Sassari the number of hides dressed annually is 14,000 to 15,000, valued at a trifle over £1 each. Tanning materials are obtained in great abundance and in excellent quality from the numerous cork and oak trees of the island.

The two great drawbacks to the progress of the island seem to be the large extent of malarial undrained land and the want of capital. The former is being gradually removed, though it will probably be several years before the full benefits of the drainage operations can show themselves. The want of capital makes itself most apparent in the lack of machinery, and in the absence of large industrial establishments. Indeed, the mining industries are the only ones in which signs of activity, energy, and enterprise manifest themselves. A large proportion of the railways have been built in order to facilitate the transport of mining produce from the mines to the seaports.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of the Council, held on 14th November, Diplomas of Fellowship were awarded to the following Ordinary Members of the Society, on their application:—Rev. John Inglis, D.D.; W. Walsh Pearson, Esq.; Professor Vaughan-Stevens. The Honorary Diploma was awarded to Henry O'Neill, Esq., and E. G. Ravenstein, Esq., for distinguished services in African Geography.

GEOGRAPHICAL NOTES.

ASIA.

Johore.—We have received from Dato James Meldrum, F.R.S.G.S., the following notice on Johore :

Owing to the favourable geographical position of Johore and the popularity of the present ruler, H.H. Abubacker, Sultan of the State and Territory, the country at no distant date will become one of some importance among the States of the Malay Peninsula. Its extent, including some islands in the China Sea and in the Straits of Malacca, may be estimated at about 10,000 square miles. Bounded by the British settlement of Malacca and the protected State of Pahang on the north, by the China Sea on the east, by the Straits of Malacca on the west, and on the south by Sulat Tebrau, which separates Johore from the island of Singapore, from which port it is distant about 15 miles, it will be seen at a glance that, besides proximity to that flourishing centre of commerce, it is not only the key to all the states and countries to the northward, but commands the entrance to the China Sea, and is on the direct line of future communication between India and Australia. At present the energetic South Australian people are constructing, as fast as their circumstances will allow them, a railway from the city of Adelaide across the continent of Australia to Port Darwin in the north. From Singapore to Port Darwin the run may be made in six days. Many besides Australians are now looking forward to see the first link of a trunk line to Burma and India made by commencing at Johore ; but the greatness of such an undertaking resolves itself into a question of an Imperial nature, and for various reasons merits immediate attention by the British Government.

According to the Admiralty charts, the latitude of the town of Johore Baru is 1° 32′ 14″ N., and the longitude 103° 48′ 15″ E. Being so near the Equator, a continual summer is experienced, and the great forests of the interior regulate the rain supply, so that no droughts are felt for any length of time. The heat and frequent showers bring on vegetation very rapidly. It is not possible for any place within the tropics to be more healthy ; there are no epidemics, no extreme heat, no hurricanes, no famines or earthquakes, although, doubtless, ages ago the island of Singapore was separated from the mainland of the Malay Peninsula by some convulsion of nature, and thus the Sulat Tebrau, or old Strait of Singapore, was formed. The tides rise and fall from 8 to 10 feet day and night, and are nearly equal all the year round. In passing, it may be remarked that ships belonging to the old East India Company used this Strait on their route to China before the island of Singapore became a British possession ; and here it should be mentioned that it was owing to the goodwill and good offices of the Sultan's grandfather that Sir Stamford Raffles obtained on very easy terms indeed that now most important island, which is the great commercial centre of the adjacent countries of Borneo, Java, Sumatra, Siam, and the islands of the Eastern Archipelago.

The population of Johore is about 200,000, composed principally of Chinese, who here are welcomed, and come in ever-increasing numbers. The just and impartial rule of the enlightened Sultan answers well. All are allowed to enjoy their legitimate gains, and as far as possible are protected from the oppression of their fellows. The bulk of the Chinese are engaged in the cultivation of gambir (*Uncaria gambir*) and pepper (*Piper nigrum*) ; a great

many are shopkeepers and petty traders, masons and carpenters. The Malays, whose country it is, are a quiet, gentle, and orderly people, but, owing to climatic influences, are not much disposed to hard work. A great improvement is going on in the rising generation. The Sultan established schools in his dominions at the commencement of his reign, and the good effects are now apparent in the young men who fill various Government situations with conspicuous ability. It is against the Sultan's orders for his people to carry weapons, so *amoks* are seldom heard of. Most of the Datos are in Government employ; the mass of the people are engaged in fishing and in wood-cutting, or are settled on the banks of the numerous small rivers, where they live in comparative comfort, their wants being few.

The aboriginal inhabitants are not numerous; they live a wild, roaming life in the dense jungles of the interior, and are called Jakuns, Binua, etc. There are some orang-laut, or sea-gipsies, who live in boats. Some attempts have been made to induce them to live on shore, but after a while they take to their floating homes again.

The highest mountain in Johore is Gunong Lidang, called by Europeans Mount Ophir. It has been computed to be 4186 feet above the sea-level. Blumut is about 3500 feet; Chimudong, 3000 feet; Montahar, 2500 feet; Pulai, 2000 feet; Pauti, 1680 feet; and Batu Pahat, 1500 feet high. Gold is found by washing the soil; and at Mount Ophir are the remains of ancient workings. Tin is obtained at various points. The principal rivers are the Johore River, falling into the Tebrau Strait at the east end; the Muar, falling into the Straits of Malacca; and the Indau, falling into the China Sea. There are numerous small streams, on the banks of which are found small *campongs* or villages of Malays: the shopkeepers at those places are all Chinamen. As far as the influence of the tide prevails, the mangrove reigns supreme. Alligators are plentiful. In the forests are upwards of 400 different kinds of timber trees adapted for every purpose to which timber is applied. Until a railway runs through the heart of the forest little can be done. There are elephants, tigers, panthers, rhinoceroses, a small bear (the plandok), resembling a miniature deer, and wild pig. There is a variety of different kinds of monkeys, among them the orang-utan: in Malay *orang* signifies "man," and *utan* "the forest." Of snakes there are many kinds; a few only are poisonous. Owing to the denseness of the undergrowth of the Johore forests it is difficult for Europeans to go after game. Of birds there is no great number. There are rhinoceros horn-bills, kites, and hawks, several sorts of small birds, the toucan, or answering bird, flying foxes and bats, owls, and other night-birds.

The staple products of Johore are gambir and black pepper. This article is extensively used in Europe and America in tanning and dyeing, and has of late years risen greatly in price—say from $5 to $10 per picul. Black pepper has more than doubled in price. No less than 22,633 tons of the former, valued at $2\frac{1}{4}$ millions of dollars, and 6130 tons of the latter, valued at 1,829,220 dollars, were lately exported from Johore. The soil and climate are particularly well adapted for the cultivation of those articles, and for tea it is exceptionally well suited. Near the town of Johore Baru the soil contains laterite in abundance. Farther northwards it becomes of a browner colour and finer sort, well adapted for the cultivation of tobacco, tapioca, sugar-cane, rice, betel, and coco-nuts, fibrous plants—indeed any tropical plant. Fruit is plentiful; all the year round plantains, pine-apples, sour sops, custard apples, green coco-nuts, etc., are to be had in the market. In their season the famed durian, mangusteen, bread-fruit, limes, oranges, melons, guavas, nangkas, potatoes, yams,

pomegranates, pomoloes, rambootans, tomatoes, etc., are to be had, either grown in Johore or imported. The water is excellent—a matter of the greatest moment anywhere, but especially within the tropics.

Besides founding the town of Johore Baru, the Sultan is laying out another, about 80 miles up the coast, to be called Bander Maharanee. Schools are established at several places. Planters are encouraged, and all are secured the gain they obtain by trade, agriculture, etc. Johore is a free port; no vexatious regulations hamper business. The laws of the country are assimilated in some measure to those of the Straits Settlements.

AFRICA.

The Basin of the Congo.—A great deal of information concerning the Congo, particularly the lower course, and the projected railway, is to be found in the *Bulletin de la Soc. R. Belge de Géographie*, July-August 1889, and in the *Bulletin de la Soc. R. Belge de Géographie d'Anvers*, tome xiii. 4^{me} Fasc. In the former Captain Jungers describes the Lower Congo, and in the latter Captain Thys, a Belgian staff-officer, discusses the commercial prospects of the Congo Basin and the effects the railway are likely to produce. The estuary of this mighty river, between the Banana and Shark Points, is 8 miles, and soundings have indicated depths of 60 fathoms. The current at the mouth is very rapid, certainly not less than 3 knots an hour, or a little over 5 feet per second. Taking the vertical section at the mouth to be a triangle, the base of which measures 8 miles and the altitude 60 fathoms, it will be found that about 1,060,000 tons of water are poured into the sea per second. The effect of this huge volume is perceptible as far as six degrees of latitude northwards from the mouth of the river, or to a distance of 360 nautical miles, so that a vessel making for Banana feels this formidable resistance after crossing the Equator, and its speed is diminished. Sailing-vessels have often to wait for weeks until a spring-tide, or a strong wind springs up, and enables them to enter the river. Another phenomenon is the current caused by the water at the edge of the stream losing its onward velocity, and being forced back towards the land, where it spreads itself out along the coast. The ports along this coast, such as Kabinda, Loango, etc., are only roadsteads with but little shelter. Vessels have to be loaded and unloaded by lighters towed by small tugs. The lighters are sometimes overturned, when their cargo, if it be palm-oil, for instance, floats, and the owners know where it will be found on the shore. For example, any article that falls into the sea off Landana, two miles out to sea, will arrive at the shore near Sette Cama. This current is not felt beyond Cape Lopez, for its effect is neutralised by the rivers Gabun and Ogowé. When a vessel, coming from the north, arrives at about 30 miles from the mouth of the Congo, it crosses a clearly marked line on the surface of the water. On the side of this line towards the Atlantic the water is of the greenish, milky colour which announces the proximity of land; on the other, it has the characteristic colour of the river—a brownish yellow. The ship has now entered the waters of the Congo, though the land is scarcely yet visible. The pilot signals, buoys, and landmarks set up by the Government render it a very easy task to take a ship into the port of Banana. After skirting the bank at the Point, she enters at once into a magnificent bay, where a whole fleet could ride at anchor. This port far surpasses all others along the coast, and it is astonishing that no one thought of occupying a spot so favourably situated at the mouth of one of the mightiest rivers of the globe until some slave-traders in the present century took up their quarters at Banana Point. Cases of illness are rare, and invalids speedily recover in this

healthy spot. The heat is rendered supportable by the sea-breeze, which blows from ten o'clock in the morning.

The basin of the Congo and its affluents has an area of about 386,000 square miles. The navigable waters, measuring together about 7140 miles in length, are given in the following table :–

	Miles.		Miles.
Congo,[1]	994	Brought forward,	3660
Kassai,	559	Bunga,	93
Lukenje,	497	L. Matumba,	155
L. Leopold,	279	Mobangi,	621
Sankuru,	435	Chuapa,	612
Lomami (Sankuru),	62	Bussera,	224
Lubi,	62	Ikelemba,	93
Lulua,	43	Lulongo,	503
Kuango,	186	Lopori,	186
Juma,	93	Mangalla,	124
Lefini,	31	Itimbiri,	124
Mpaka,	47	Aruwimi,	124
Alima,	186	Lomami,	621
Likuala,	186		
Carry forward,	3660	Total,	7140

The meaning of such large figures is hard to grasp, and therefore one or two illustrations may be of use. The area drained by the Congo and its tributaries is more than thirty-three times the area of Belgium, and nearly as large as Holland, Belgium, France, Switzerland, Italy, and Ireland united. The length of both banks of the navigable waterways, namely 14,280 miles, is about that of the coast-line of Europe from North Cape to Constantinople. In addition to this, the Lower Congo extends for about 120 miles from the mouth to Matadi, where the region of cataracts commences, and consists of two portions differing considerably in character. From Matadi to the Ile des Princes, or thereabouts, wild scenery, steep mountains, and torrents falling headlong into the river show that the volcanic forces which formed the region of the cataracts extended their energy over this district also. Below this island the river expands at once to double, and a little lower down to three times, its former breadth, and at last measures about 12 miles across instead of $2\frac{1}{2}$. It is studded with numerous islands, larger streams flow into it, its banks and the hills beside it are rounded, and the whole country has a tame appearance. Between Boma and Ponta da Lenha the islands are only banks of sand covered with grasses and sickly-looking shrubs, but below that point they bear a luxuriant vegetation. A further diversity in the vegetation and soil is caused by the tides. The salt water ascends the river as far as Malella, so that while the islands above are covered with oil-palms, baobabs, and wild cotton, on those towards the mouth of the river the effect of the tide may be seen in the increase of bamboos and the diminishing number of palms, etc. The latter islands are submerged at exceptionally high tides, whereas those above Malella have a fairly dense population. As soon also as the fresh water is entered, alligators and hippopotami are met with. The navigation of the Lower Congo is rendered difficult and dangerous by the rapid changes that take place in the depths of the channels. Some twenty years ago steamers always followed the northern bank between Ponta da Lenha and Boma, for the Fetish

[1] From Stanley Pool to Stanley Falls.

Rock passage was practicable only for crafts drawing less than 6 feet, whereas now this passage has a depth of about 190 feet, while opposite Kanga a boat drawing 11 feet of water would certainly touch ground. Several other similar cases might be quoted. Again, when the tidal waves are urged forwards with more than usual violence by the wind, which generally blows from the sea from ten o'clock in the morning, the struggle of these waves with the waters of the river is so fierce that it is felt as far as Binda, 93 miles from the mouth. At such times boats are obliged to keep close to the banks, or they would be swamped immediately. Ocean steamers ascend as far as Boma, and small steamers belonging to the Congo State ply along the river up to Matadi. From the soundings taken by Captain Boyé, however, which show that the channel is nowhere less than 60 feet deep, it is considered that large steamers may safely ascend to Matadi at a speed of 9 to 10 knots. The large quantities of water which are poured into the Congo during the rainy season cause great changes of level. The water rises gradually through June, July, and August, and attains a maximum height between the 13th and 25th of September, after which it decreases up to the middle of February, and attains a second but lower maximum at the end of April.

North of the river, between Banana and Ponta da Lenha, lies an arid plain. The soil is a compact clay interspersed with lagoons, which are flooded at high tide, and are covered with impenetrable vegetation, chiefly papyrus. At a distance of from 3 to 12 miles from the river the country entirely changes its aspect: here hills, 300 feet high, are separated by broad valleys, and the soil is light, and, no doubt, very fertile. Fifty to 55 miles from the river, Mayumba—*i.e.* the land of forests—is entered, which supplies the greater part of the merchandise shipped from the ports of the Lower Congo, and of the coast between that river and the Gabun. Four tribes inhabit this country: the Mussorongos, who dwell on both banks of the river and the islands between Ponta da Lenha and Banana, the N'Zaadi along the river to the east of the Mussorongos, the Kacongos to the north of these tribes, and, beyond the Kacongos again, the Mayumbas. The natives have a gentle disposition, and their barbarities are due entirely to the old-established rites of fetichism. They attack a village on slight provocation, but disturbances among the inhabitants of the same village are very rare. Drunkenness, except perhaps at the great feasts, is not a common vice. They are by no means impervious to new ideas, and, if the Government can put down the tribal wars, they will probably make great progress in civilisation.

Between Matadi and Stanley Pool merchandise has at present to be carried overland at a great expense. A railway has therefore been projected to connect the Upper and Lower Congo, and thus provide a cheaper and more commodious means of transport from the interior. The distance, as the crow flies, is 174 miles, but the railway, in order to take advantage of the formation of the ground, and avoid all great engineering difficulties, will be extended to a length of 264 miles. The cost is estimated at £1,000,000 sterling.

Le Mouvement Géographique, November 3, 1889, notices a new edition of three sheets of M. Lannoy de Bissy's Map of Africa, which embrace the greater part of the Congo territory. Several important changes may be observed in this edition, particularly near the cataract region. The French Rouvier Mission has furnished more complete and exact information than has hitherto been attainable regarding the course of the Kuilu and the country north of Manyanga, and the Belgian Cambier Mission has supplied details concerning the country on the south bank, between Matadi and Leopoldville. The survey for the railway

has also determined the position of many points more exactly. The position of Mboko Songo has been removed about 20′ towards the north, and therefore the sources of the Chiluango, in the neighbourhood of this place, have undergone a similar displacement, whereby the basin of the Congo, and consequently the territory of the Congo State, have been enlarged. The middle course of this river has also undergone changes in direction, and its affluents, the Luisa and Luali on its right bank, and the Lukula, on its left, are represented as the important streams they really are. The tributaries also which enter the Congo in the region of the cataracts are put down from their sources to their confluences. With regard to the upper courses of the Inkissi, and the small stream between the Pool and Msuata, called by Stanley the Black River, the *Mouvement Géographique* considers that M. Lannoy de Bissy has traced their courses incorrectly. The source of the former is placed some 30 miles only beyond the point where the engineers engaged in the survey crossed it, too short a distance for a river to acquire a breadth of more than 100 yards and a considerable depth. Again, the Black River, which is only 15 to 25 yards across at its mouth, figures as the lower course of the Ntasi Malio, the parent streams of which Messrs. Buttner and Wolf crossed at 6° and 6° 30′ S. lat., and therefore has a length of 200 or 250 miles. *Le Mouvement Géographique* believes that the Ntasi Malio is the upper course of the Inkissi.

Between Stanley Pool and Kwamouth the river runs swiftly between mountains often 600 to 1000 feet high, and covered with forests. Only at Msuata is this barrier broken. Here the land rises from the shore in terraces, and is inhabited. As far as Chumbiri the river widens very gradually, but above it expands considerably, and is generally very broad all the way to Stanley Falls: it is often fifteen, and sometimes as much as twenty-one, miles across (the distance from Calais to Dover). Between Bolobo and Lukokela a marshy tract occurs, a slight blemish on this beautiful river.

All along the banks of the Upper Congo are frequent villages, and even towns. Bolobo, for instance, has a population of 30,000 souls, public squares, and regularly built streets. Considering the enormous length of waterways, and the fertility of the soil, the new railway, by which all the exports must reach the Lower Congo, should prove a success. The products of the country have already been described in the *Scottish Geographical Magazine* (vol. ii. p. 482), as well as the discovery of the length and direction of the Lomani, which will, no doubt, play an important part in the development of the Congo territory.

The Welle-Makua and its Affluents.—The scientific results of Dr. Junker's explorations in Central Africa have been made known to the world in two supplements to *Petermann's Mitteilungen*.[1] One of them deals with the "Hydrography, Orography, and Ethnography of the Basin of the Welle-Makua," the main features of which are reproduced in *Globus* (Bd. lvi., No. 11). The other supplement contains Dr. Junker's measurements and meteorological observations, and also a map of Central Africa on the scale of 1 : 750,000. The region about to be described lies between the Nile on the east and the unknown lands in about the 23d meridian E. long., while it is bounded on the south by the river Nepoko, and on the north extends to the homes of the Dinka, Bongo, Jur, and Krej. Of this tract about 154,000 square miles are drained by the tributaries of the Congo—the drainage area of the Welle-Makua alone is about 138,000 square miles—so that only 12,000 square miles are left for the Loika-Itimbiri,

[1] *Vide S.G.M.*, vol. v. pp. 100 and 383.

and 4000 for the Nepoko. The principal watershed of this country commences from the east in the Blue Mountains, a group lying to the north of the Albert Lake, the summits of which—over 6500 feet high—are named after noted Central African explorers. At first the direction of the watershed goes northwards, but almost exactly at 3½° N. lat. it suddenly turns westwards. Up to this point the mountains are of considerable elevation, 4000 feet and over; but here the character of the country changes, the grand mountain chains split up into numerous small ranges, with scattered pyramids of rock and groups of hills, while the maximum elevation sinks at last below 2000 feet. From the turning-point before mentioned the watershed runs in a curve north-westwards, passing through the intersection of the 4th parallel of N. lat. with the 30th meridian of E. long., where it again turns to the north, a direction which it maintains up to 4½° N. lat. Here it turns over the hills Oduku and Angabbi sharply to the south-west. Jebel Baginse marks its course as it passes to the 28th meridian, where it again assumes a north-westerly direction; it soon after crosses the 5th parallel, and, entering the ranges of Pambialand a little south of the 6th parallel, passes on towards the 26th meridian and the 7th parallel. Once more it bends northwards as far as the 8th parallel, and then proceeds westward through several degrees of longitude. At the 23d meridian this watershed ceases to separate the basins of the Welle and the Nile, and henceforth parts the waters of the Congo and the Shari. Dr. Junker's measurements give the height of the watershed at the sources of the Kibali as 4600 feet; at the first turning-point westward, 4200 feet; from Tomaya's country past Baginse to Wando, 3300 feet; and from Wando past Ndoruma to Dem-Soliman, neglecting a few summits of exceptional elevation, 2300 to 2600 ft., on an average. The country in general is more or less undulating, with a few isolated hills, deep valleys, and small plateaus rising abruptly from the surrounding land. The sources of the Welle lie on the 31st meridian, and between 2½° and 3½° N. lat., on the western slopes of the Blue Mountains, at an elevation of about 4200 feet above the sea-level. The parent rivulets unite some 300 feet lower to form two great streams, the Sir and the Kibbi. The young streams meet and rush down westwards to their confluence with the Dongu, falling 1600 feet in about 150 miles. The united rivers receive the name of Kibali, soon, however, to be replaced by Welle or Welle-Makua. The current continues swift for the next 60 miles to the mouth of the tributary Gadda, which comes from the south. The fall during this short course is nearly 100 feet, most of which occurs at the Kissanga Rapids, discovered by Dr. Schweinfurth. From the last-mentioned point the river-bed is uniform, with high, and in many places perpendicular, banks; the depth of water varies considerably with the season. The fall is only 30 feet to the confluence of the Mbruole (43 miles), and about the same between the Mbruole and the place where Junker crossed from the A-Madi to the A-Barmbo (53 miles). Here, at the mouth of the Gurba, the river suddenly forsakes its westward direction and makes a long curve to the south, round the A-Madi country. At some far distant period the river must have been forced aside by the upheaval of groups of mountains along an axis lying approximately in a west-north-westerly direction, of which the hills and mountains now existing are the remains. At the most southern point of the curve lies the Majanu; to the north-west of this mountain, across the river, rises the Ngurra or Angba, followed by the Lingua, and, finally, by the Malingde, which last stands nearly at the middle point of the chord of the arc. Dr. Junker gives the height of the Lingua—for which alone he seems to have reliable measurements—as 3050 feet. The river regains the altitude of the mouths of the Gurba and Mbruole, where the Hekke, a little

stream which rises on the Malingde, joins it, and henceforward steadily pursues its westerly course up to 22° E. long. Along the curve are seen numerous green, inhabited islands, sometimes collected into groups, and the banks are clothed with luxuriant woods, containing a large variety of trees. Of a very different character is the next reach, from the brook Loï to the southern affluent, the Mbima, a distance of 134 miles. It has not at present been explored; but, from its fall of 360 feet, the existence of whirlpools, rapids, and cataracts may safely be inferred. Dr. Junker believes that the Welle does not here traverse a mountainous region, but that its sharp fall is due to a general sinking of the whole country from the eastern plateaus to the low plains westwards of the 23d meridian. He saw the river from the village of the chief Bagbinne, opposite the mouth of the Mbima, where he found the surface of its waters to be still 1478 feet above the sea. The bed was so crowded with islands that the total breadth could not be ascertained, but the northern arm alone measured more than 500 paces; the banks are low, and floods frequent. Between the mouths of the Mbima and the Werre, by the island Kombiako, are situated dangerous cataracts, and similar obstructions of the river-bed are of frequent occurrence all the way to Ali Kobbo's village, Dr. Junker's furthest point (23° E. long.). Between this point and Capt. van Gèle's furthest (22° E. long.), the river has not been visited by any European. (The exact longitudes are given in *S. G. M.*, vol. iv. p. 332, as 22° 55′ and 21° 55′ E. long., respectively, and the distance between these points as 111 kilomètres = 69 miles.) The numerous channels into which the bed of the river above Ali Kobbo's is divided by islands, are said to unite into one a little below that point. Shortly before reaching the 22d meridian, the Welle receives its largest affluent, the Mbomu, after which it assumes the name Mobangi. The country is here flat, with no mountains to relieve the monotony.

The tributaries of the Welle have next to be considered. Taking first those on the right bank, the Dongu, which has already been alluded to as the first, probably rises in the Ndirsi Mountains, on the main watershed, close to the sources of the Yei, Rohl, and Issu. The Duru rises in the hilly country south of Mount Baginse, and in its lower courses forms numerous swamps, in which it is imitated by its tributaries, as well as by the third affluent, the small river Kapili. The Mbruole, which corresponds to the Yubbo on the northern side of the watershed, is a much larger river. Where it enters the Welle, not far from the mouth of the Gurba, and near the great southern bend of the main stream, it is 75 paces across. It runs, like its predecessors, from north-east to north-west, whereas its western neighbour, the Gurba, lies north and south. The sources of the latter river are situated in Ndoruma's territory, where also rises the sixth northern tributary, the Werre-Oepi, which in its important affluents and its length far surpasses the streams already mentioned. It is separated by a plateau from the affluents of the Yubbo, and, about the middle of its course, passes a chaotic group of steep, bare, granite hills, of which the highest, the Emba, has an elevation of not more than 400 feet: otherwise the monotony of the country, gently undulating mile after mile, is broken only by the Keddede and the Niango. The Werre runs in a south-westerly, and sometimes westerly, direction over about 2½ degrees of longitude. It is broad, and has a moderate fall, so that it may be navigable for some distance, as Dr. Junker was informed by the natives. The Duma, a considerable stream, joins it on the northern bank, and small streams descend into it from the secondary watershed between the Werre and the Mbomu. Near the 22d meridian is the mouth of the Mbomu, which surpasses all the other tributaries of the Welle, those of the left bank included, in the volume of its waters, its breadth, and its drainage area.

Rising in about 27½° E. long., and running in a direction more westerly even than the Werre over nearly 5½° of longitude, it must have a length of about 370 miles. It has a considerable fall : according to Junker, 460 feet during its upper course of about 95 miles, 230 feet in its middle course of 110 miles, and fully 330 feet in its lower course of 165 miles. It has four important tributaries on the northern side, the domain of which reaches the 8th parallel. The first two are the Boku and the Kelle, which rise in the Daragumba and Pambia mountains (27° 30′ E. long.) respectively. The third, the Warra, called also the Fua or Fonj, corresponds to the Busseri and the Jih of the Bahr-el-Gazal basin. The fourth and far most important, the Shinko, descends from the 8th parallel, and therefore in its upper course passes through the zone of shorter rainy seasons : it has a broad shallow bed and low banks. The southern tributaries of the Mbomu are more numerous, but comparatively insignificant, and only the Mbili, which runs nearly at equal distances from the Welle and the Mbomu, need be mentioned. Between the zeriba Bansinge on the Mbili and Ombanga, a long distance to the north-north-east, Dr. Junker traversed a singularly dreary country of rocky plateaus, alternating with strips of desert, almost treeless except on the river banks, without a mountain or even a hill.

On the south side of the Welle the proximity of the Nepoko and the Congo prevents the development of many large tributaries. The direction of the watershed in this unexplored region cannot be traced exactly, but the second parallel probably marks the southern boundary of the eastern part of the basin of the Welle. Here rises the Bomokandi, which flows in a westerly direction, and, lower down the main stream, the Mbima, already mentioned, empties itself into the Welle nearly opposite the Werre. Seeing that two degrees of longitude intervene between the sources of the Kibbi and Sir, visited by Junker, and the route of Emin Pasha in the country of the Mari and Mangbattu, it is extremely probable that the Kibali here receives the water of many streams unknown at present. Dr. Junker heard of the existence of one, the Yubbo, on the southern bank ; and Dr. Schweinfurth saw another, the Gadda, farther to the west. The sources of the latter lie on the mountains of the A-Bangba, at an elevation of about 2560 feet, and it enters the Welle at a height of 2230 feet above the sea ; so that, on a rough calculation, it falls 330 feet in a course of about 620 miles. The drainage area of the Welle on its right bank is estimated at about 92,000 square miles, and on its left bank at about half as much.

The Rudolf Lake : Hydrography of its Basin.—In *Petermann's Mitteilungen*, (Bd. 35, x.), Lieut. von Höhnel, one of the discoverers of the Rudolf Lake,[1] discusses its hydrographical relations. A large cleft in the earth's surface lies pretty nearly along the 36th meridian of east longitude, and extends from 4° S. lat. to 6° N. lat. This cleft is bounded on the east by a prolongation of the mountain system of Abyssinia, which may be said to end at Kilima-njaro, and on the west by a large chain known under different names in different parts, as the Kamassia, Elgeyo, and Suk ranges, and ending to the north in the Karamoyó and Turkana chains. In this cleft lies a chain of lakes, beginning to the south with Lake Manyara and ending in the Rudolf Lake. The highest of the chain is Naivasha (6000 feet), and from this point the valley slopes northwards and southwards. The Angata Nairogua lies at an elevation of about 5800 feet. Baringo 3723 feet, the Rudolf Lake only 1548 feet, while the Natron Lake, on the southern slope, is 2132 feet above the level of the sea. None of these lakes

[1] Compare Count Teleki's account, with a map, of Rudolf Lake in *S. G. M.*, vol. v. p. 96.

has an outlet, and it is curious to notice that some of them have sweet water, while others hold large quantities of salts in solution. The explanation may be sought for either in subterranean outlets or in the periods of their formation being separated by long intervals of time. There are no observations of old date on record concerning the increase or decrease in the quantities of water contained in these lakes. Lieut. von Höhnel is of opinion that the Naivasha remains unchanged or decreases very slowly, while the Baringo decidedly decreases, though not very quickly. With regard to the Rudolf Lake, the evidence is so contradictory that, he concludes that its level changes at different periods. The lake, as far as has been at present ascertained, extends from 2° 16′ to 4° 47′ N. lat., and is long and narrow. Its area is about 3500 square miles. The banks are generally rocky, or composed of fine sand. In some places, particularly at the southernmost corner, the mountains fall so suddenly into the water that it is impossible to walk along the side of the lake. Low banks are found on the western side, about the middle of its length, and at the north end. Reeds grow only at this end, probably because the two rivers which enter the lake here render the water sweeter than elsewhere, for the Rudolf Lake is strongly impregnated with soda. In other parts the banks are bare, and composed of volcanic rock : the vegetation is scanty, and the character of the country desolate. Strong hot winds, laden with sand, blow almost continually from the south-east, and render a sojourn here very disagreeable. At the north end, however, the nature of the country is very different. Here the only two perennial streams in its basin enter the lake. The two large rivers in the south, the Irrguéll and the Kerio, which descend from the Suk and Elgeyo chains respectively, as well as the small streams which enter the lake on the north-eastern side, are filled with water in the rainy season only. The western river of the two entering at the northern end is named by the natives the Bass, and the other the Niánam. Through their agency the beautiful blue colour, which has gained for the lake the name Basso Narók (*i.e.* black, blue, or dark lake), disappears here, and the water is yellow and muddy. The trees look sickly, for in the rainy season the water of the lake and rivers overflows the adjoining land for a considerable distance, and, when it abates, large quantities of mud are carried into the lake, whereby the depth is diminished and the surface extended. The lower part of the Niánam was frequently visited by Lieutenant v. Höhnel's men and once by himself, and the observations then made agreed with the information obtained from the Reshiáts (a native tribe). Its bed is about 100 paces broad, and its velocity is, perhaps, about 1 mile per hour. In the rainy season its waters are of a dark-brown colour, and contain a large quantity of dark earth. Trees and bushes grow luxuriantly along its banks. The Bass, which flows parallel to the Niánam in its lower course, is, according to many concurrent statements, very broad (more than 2000 yards), but shallow, fordable, and with scarcely any current. Perhaps this is true in the rainy season, when the banks are covered with shallow waters. Lieutenant von Höhnell examined more or less closely about seven-eighths of the perimeter of the lake and found no outlet for its water, nor did the natives know of any. That such was the case might have been inferred *a priori* from the soda contained in its waters.

Lieutenant von Höhnel was able to trace by inquiries only about 45 miles of the Niánam. Beyond this point it was said to flow from the north-east or east. On consulting a map it seemed to him evident that the Omo and the Niánam were the same river ; and Captain A. Cecchi, a supporter of Léon d'Avancher's Omo-Jubba theory, was immediately converted to this opinion. Less doubt

could be entertained after the return of M. J. Borelli, who had followed the Omo as far as 6° 20′ N. lat., farther than any of his predecessors. He heard that it followed the sixth parallel of latitude, and that, some 130 miles from the point he reached, it flowed into a lake named Shambara or Shamburu, which was said to be small and shallow and to have an outlet on the south-western side. It is evident that Borelli's information is in harmony with Lieutenant von Höhnel's, supposing the Omo to be identical with the Niánam; and, considering the short distance between the points to which their reports relate, it is scarcely credible that these should be two distinct rivers.

It might be suggested that Borelli's Shamburu is identical with the Basso Narók or Rudolf Lake. To this Lieutenant von Höhnel answers, that the description given to Borelli of the Shamburu does not apply to the latter lake, and that the tribes said to dwell around it have different names from those borne by the tribes of the Rudolf Lake. Besides, the Austrian travellers, as they came from the south, never heard the name Shamburu or Samburu applied to a lake, nor did the natives of the northern bank of the Rudolf Lake know of such a name. On the other hand, the natives made some indistinct allusions to another lake which were not understood at the time, and also reports have been heard before on the northern side of the existence of a Samburu Lake, and of a Bow or Bo Lake. Bow, Bo, and Baro, according to Cecchi, signify in the Sidama tongue the same as Basso—*i.e.* lake. Wakefield fell into an error by supposing that the name Samburu, by which the Burkenejjis distinguish the country east of the Rudolf Lake, was that of a small lake near Marsabít.

Lieutenant von Höhnel demonstrates in the next place the impossibility of the existence of any connection between the Rudolf Lake and the Nile. The elevation of the Rudolf Lake was ascertained by sixteen observations to be 1548 feet. The Nile at Ladó is 1525 feet above the sea. This, then, is the most southern point that need be taken into consideration. North of this the river by which the communication in question might be established, if at all, is the Sobat, which enters the Nile at an elevation of 1378 feet. If, then, the Sobat be an effluent of the Rudolf Lake, it falls only 170 feet during a course of some 1150 miles. Again, Dr. Junker, who in 1876 travelled up this river as far as Nasser, a distance of 186 miles, estimates the current at 2½ miles per hour. A rough calculation shows that the Sobat must therefore have a fall of more than 170 feet in this comparatively short distance. This settles the question. Neither can the Rudolf Lake pour its waters into the Nyanza, which has an elevation of about 4000 feet.

The Sobat receives in its middle course the Jibba or Jubba on its left side, and several streams coming from the north and east. Its basin, then, seeing it flows from north to south, must sink in the same direction, while it must rise again on the right side towards the mountain country of Abyssinia, for tributaries flow to it from that direction. Now, since Nasser has an elevation of about 1650 feet, J. M. Schuver's 'Haarlem Lake,' supposed to be situated in this district, must have a greater elevation, if its waters are drawn off into the Sobat. According to Schuver, a stream called Baro descends from the mountains and forms the Haarlem Lake, while Cecchi, from information he received, supposes that another stream called Baro runs into this lake from a point exactly coinciding with the northern end of the Rudolf Lake. It is, of course, impossible that a stream should flow from the neighbourhood of the Rudolf Lake to the higher country of the Haarlem Lake; and Lieutenant von Höhnel is inclined to believe that these two Baros are identical with the Bass, which flows into the Rudolf Lake. It has been already stated that Baro, Bass, Bow,

and Bo have the same meaning. The Rudolf Lake and its feeders form, therefore, an isolated or self-contained system.

Finally, Lieutenant von Höhnel gives a short description of the Stefanie Lake, called by the Burkenejjis Basso Ebór or White Lake. Its area is about 359 square miles, and its elevation 1909 feet. Its water is undrinkable, being strongly impregnated with Epsom salts. Though surrounded on three sides by mountains, its banks are low and the water shallow, especially on the south side, where there are often a few inches of water at a distance of several hundred yards from the shore. There is only one stream, which enters the lake at its northern end. The lake has evidently been receding of late years very considerably. It has no outlet to the Rudolf Lake or in any other direction, and therefore forms another small hydrographical system.

The British South Africa Company has, under Letters Patent dated 29th October 1889, obtained a Royal Charter of Incorporation. Its principal field of operations in the region of South Africa is that "lying immediately to the north of British Bechuanaland, and to the north and west of the South African Republic, and to the west of the Portuguese Dominions." It will therefore be seen at a glance that its western sphere of influence is limited by the 20th meridian of E. longitude, where it is coterminous with the German boundary line: that its eastern boundary is very much "in the air" owing to the unsettled claims of Portugal; and that its northern limit, if "immediately" outlined by the Zambesi River, is quite undefined and illimitable, and may or may not extend up to the Lakes Region in the course of natural expansion and acquired rights. That the Company is entering a region of boundless possibilities, and also, it must be added, of boundless responsibilities and perils, is equally obvious. Besides the South African Republic, one small region—that of Tati—is adjudged outside of its concessions. The limits of the district of Tati are described as "from the place where the Shari River rises to its junction with the Tati and Ramaquaban Rivers, thence along the Ramaquaban River to where it rises, and thence along the watershed of those rivers."

There is one distinction which characterises this Charter from others granted in Africa: it is the controlling power which H.M. Secretary of State reserves in his hands as regards the political action of the Company. That this may be an element of strength in the dealings of the Company with foreign powers and the natives, or an element of weakness, should our characteristic hot-and-cold policy—"one step forward and one back"—continue to muddle the affairs of South Africa, cannot be questioned. We congratulate the Company on having the courage to take up a work which, in the first instance at least, can only be achieved by a chartered body, the importance of which on the future of South Africa it would be difficult to overestimate. Both in natural wealth and favourable geographical position, the Company thus enters the finest lands of Africa.

Island of Réunion.—M. Adrien Blondel contributes to the *Bulletin* (4e Trimestre, 1888) of the Paris Geographical an article on the above, of which the following is a *résumé*:—When the island was discovered in 1545 by the Portuguese Mascarenhas, it was uninhabited. The first colonists were introduced in 1664 by the French East India Company, to whom Louis XIV. ceded Madagascar and its dependencies. They established themselves at Saint-Paul, and were soon joined by the French who escaped the massacres in Madagascar. The Company, after holding the island for one hundred years, gave it up to the King in 1764. During this period of time little had been done for the prosperity

of the colony. When the Government took over the administration there were only 25,000 inhabitants, of whom 5000 were whites; thirty years after, the population had more than doubled itself: in 1789 there were 60,000 inhabitants, of whom 10,000 were whites. The first French governors did much for agriculture, irrigation, and in the department of forestry. During the French Revolution the island, which at first was called Bourbon, changed its name to Réunion. Several subsequent changes of its name were imposed by political exigencies. It took an active part in the wars of the Revolution and of the Empire, and maintained the honour of the French flag in those seas. In the year 1810 the island was taken by the British, but it was restored five years afterwards.

Réunion is entirely of volcanic origin; its axis runs north-east and south-west; and it seems to have been produced by a volcano whose cone of eruption at first appeared in the north-east, and subsequently in the south-west, where at present it is in activity. Extinct craters plainly show the course of these eruptions; they are symmetrically arranged on either side of the axis. The principal ones have given rise to the three amphitheatres—Mafete, Cilaos, and Salazie—from whence spring the three chief torrents of the colony, the rivers Galets, St. Etienne, and Mât. These river-basins are separated from each other by high mountains, of which Grand Bénard (6744 ft.), Cimandef (7382 ft.), the Snow Peak (10,072ft.), and the triple-peaked Salazes (7054 ft.) are conspicuous. The region of the extinct volcanoes, the most ancient portion of the island, is connected with the present volcano by a vast plain, 5250 ft. in altitude, called the Sand Plain. At this height one finds the temperature and the products of Europe. At the extremity of the Cafres Plain, the active volcano, at a height of 8530 ft., sends its lavas down into the sea. The last eruption was in 1860; since that time no lavas have flowed, but there have been eruptions of cinders; earthquake shocks have been frequent enough, but slight.

The island is divided into almost two equal divisions by this grand mountain *massif*; the northern half is called the *Arrondissement du Vent*, the southern the *Arrondissement sous le Vent*. The escarpments do not reach the shore; thus a coastal zone is formed of about 6 miles in breadth, comparatively flat, but cut up by innumerable water-courses that are full in the rainy season only. This coastal belt of country is the portion of the island that is inhabited and laid under cultivation.

The principal towns are, in the northern province, Saint-Denis, the capital of the colony and seat of the government and administration, with 33,000 inhabitants, and, in the southern province, Saint-Paul, with 29,000 inhabitants, formerly the chief town of the colony, and Saint-Pierre, with 25,000 inhabitants, which is endeavouring to establish a commercial supremacy.

Réunion has only two seasons: the rainy season, from 1st December to 30th April, and the dry season, from May to the end of November. During the former the rains are abundant and the winds variable; it is the season of cyclones. In the dry season the SE. Trades strike the island in the region of the volcano, and the clouds, on condensing, water the northern province, the southern province suffering from drought. As regards temperatures, both portions of the island experience much the same conditions; the thermometer on the coast never goes below 15° C. (59° Fahr.), and attains a maximum at 33° to 34° (91° to 93° Fahr.); but these conditions are not the same in the rainy season.

The coastal zone, which contains almost all the cultivated land, grows the most valuable crops: sugar-cane, coffee, and vanilla; tobacco is grown on the heights. In 1866, of the 172,000 hectares (hectare = 2·471 acres) that comprise the

area of the colony, only 60,000 were under cultivation : 34,500 under sugar-cane, 4350 under coffee, 3300 under vanilla, 9400 under vegetable products, and 8450 under tobacco, rice, etc. The culture of sugar-cane, formerly so remunerative, has become ruinous. Vines and caoutchouc have been raised on a large scale. The cultivation of the tea-plant has been attempted with some success on the heights ; but coffee has not succeeded. All this progress has been accomplished in ten years. The labour question is, however, still the most difficult to solve.

The population of Réunion at the end of 1886 was 175,000 inhabitants, of whom 42,000 were immigrant natives of India, Kaffirs, and Malagasys, living under a special *régime*. There were moreover 500 or 600 Chinese almost exclusively occupied in the grocery business. In such a climate as Réunion the white man cannot endure field labour, and has to rely on the natives. But after the abolition of slavery the natives could not be got to work so easily, and recourse had to be had to the natives of India, whom the authorities of Réunion are allowed to recruit by a special treaty (1861) with the British Government. What with these difficulties in obtaining labour, the diseases that have been introduced by the immigrants, and the terrible cyclones, agriculture in Réunion has many drawbacks.

The island exports nearly all it produces, and imports all the articles of consumption. In 1886 the total of its exterior commerce amounted to 41,442,000 francs, of which 13,319,000 francs were exports. The trade with France amounted to about 20,000,000 francs, of which 11,472,000 were imports. Of the exports, sugar amounted to 8,560,000 ; coffee, 500,000 ; vanilla, 1,346,000 ; and rum, the traffic in which is increasing, to 550,000 francs. All this trade is carried in French ships.

Previously, in spite of several attempts made since the commencement of the century, Réunion had no good port ; now a large one, together with a dry dock, has been constructed at the north-east extremity of the island, the Pointe des Galets. As a necessary result of this, a railway has been built 125 kilomètres in length, and traversing the cultivated coastal belt of country ; it goes from Saint-Benoit to Saint-Pierre, passing by Saint Denis, the port, and the intermediate towns ; and there are twelve stations.

NEW BOOKS.

The Viking Age : The Early History, Manners, and Customs of the Ancestors of the English-speaking Nations. Illustrated from the Antiquities discovered in Mounds, Cairns, and Bogs, as well as from the Ancient Sagas and Eddas. By Paul B. du Chaillu. With 1366 Illustrations, and Map. 2 vols. London : John Murray, 1889. *Price*, 42*s*.

The interest and value of Mr. du Chaillu's work are, fortunately, made independent of the new ethnic theory to which it owes its origin. We fear that the arguments on which he bases his assumption that the Vikings are the direct "ancestors of the English-speaking nations" will never carry any weight with historians and ethnologists. Without attempting any precise criticism of his positions, it may in general terms be remarked that Mr. du Chaillu entirely ignores the important part that philology has hitherto played in the classification of races. It is significant that the English language has never at any stage shown any trace of the characteristic features of Norse speech (such as affixion

of the definite article, the formation of the passive by affixion of the reflexive pronoun, etc.), while there is throughout the closest relationship, both grammatically and phonetically, between Anglo-Saxon and Old Saxon or Low German.

The controversial part of the book, however, is mainly confined to the first three chapters, and the rest consists of a series of vivid word-pictures of Norse life and civilisation. Every aspect of this subject is elaborately treated in a separate chapter, the data having been collected from the ancient Sagas and Eddas. These have in their turn been supplemented and corroborated by the testimony of the numerous archæological remains now scattered among the museums of Europe, which have been laid under contribution to illustrate the text. The wood-cuts, numbering as many as 1366, are admirable in every respect, and enable the reader to realise the luxury and artistic refinement of an age and race we have hitherto been inclined to regard as almost barbaric. In what degree this culture was the result of intercourse with older and more highly civilised nations would be an interesting study, and we should have welcomed some attempt at tracing the origin of many of the interesting relics. The number of Greek and Roman coins and other foreign objects have a special value, as showing the wide extent of their maritime expeditions and overland trading journeys about the beginning of the Christian era. The Romans seem to have extended south through the present Russia to the Black Sea, Tigris, and Euphrates, and as far east as Samarkand, while trading vessels sailed the seas of Western Europe, and had commercial dealings with the Mediterranean. Some idea of the geographical knowledge of the Norsemen may be gathered from the following passage in the *Ynglinga Saga* :—"The round of the world on which men dwell is much cut by the sea ; large seas stretch from the outer sea round the earth into the land. It is known that a sea runs from Njörvasund (Straits of Gibraltar) all the way up to Jorsalaland (the land of Jerusalem). From it a long bay runs north-east called the Black Sea, which separates the three parts of the world ; the part east of it is called Asia, but the one west of it is called Europa by some, and Enea by others. North of the Black Sea is the great or the cold Sweden ; some say that Sweden is no smaller than Serkland (the land of the Saracens) the great ; some say she is as large as Blaland (the land of the blue-[black] men) the great. The northern part of Sweden is uninhabited on account of frost and cold, as the southern part of Blaland is on account of the sun's burning heat. In Sweden there are many large herads (districts). There are also many kinds of people and many tongues ; there are Asar, Dvergar, and Blamenn (blue men), and many kinds of strange people ; there are beasts and dragons wonderfully large. From the north, in mountains which are beyond all settlements, a river springs that flows through Sweden ; its right name is Tanais ; it was in old times called Tanakvisl, or Vanakvisl ; it flows into the Black Sea. The land round Vanakvisl was then called Vanaland, or Vanaheim (home or world of the Vanir). This river separates two-thirds of the world ; east of it is Asia, and west of it is Europa."

A mass of quotations from the sagas and earlier poems dealing with the cosmogony and mythology of the Norsemen are followed by a description of the relics of the stone, bronze, and iron ages. The number of graves, mounds, and cairns that have been discovered testify to the respect paid to the dead, and there is much that is specially interesting and unique in this section of the work. Two methods of burial were in vogue : burning the dead on the funeral pyre and burying the dead unburnt. It was believed that the dead burnt on the pyre went direct to Valhalla with all the weapons and wealth burned with them, and that these would afterwards resume their original shapes. Horses, dogs, and

even slaves were often sacrificed that the warrior might enter the next world suitably equipped. Burial in ships was a mode of sepulture peculiar to the Vikings and eminently characteristic of a seafaring nation. Vessels have been found (*e.g.* that at Gokstad, in Norway, represented in the frontispiece of the book), in which the body of the dead warrior was not burnt, whilst others were used as a pyre. The earliest account of such burial is a description of the "burning-voyage" of Baldr, son of Odin. The curious custom of a man's "giving himself to Odin," by marking, or causing himself to be marked on his deathbed, with a spear, probably arose from the disgrace supposed to attach to one who was not killed in battle.

The division of the people into classes, the elaborate system of land laws and land tenure, the laws regulating outlawry, duelling, blood feuds and their indemnities, and a description of the *Thing*, or general assembly of the freemen, brings the first volume to a close. From the earliest times we find the people exercising judicial and legislative rights, and their political constitution finds its nearest parallel, in our own day, in that of Switzerland or of the United States. Local government was established, and matters concerning the interests of the nation as a whole were discussed and settled at the *Allsherjarthing* (assembly of all the hosts).

The first few chapters in the second volume are devoted to marriage customs and the birth and upbringing of children. We are impressed by the high position held by women in these early times. "A maiden was highly respected, and on her becoming a wife she was greatly honoured, and her counsels had great weight; by marrying she became the companion and not the inferior of her husband. She held property in her own right, whatever she received by inheritance and by marriage being her own; though there were restrictions put upon her as well as upon her husband in regard to the use of her property." Marriage was not a religious sacrament but a civil contract, generally arranged between the relatives on both sides, and it was not permitted unless the contracting parties had sufficient means to support themselves in comfort. Checks were placed on the extravagance of women, but wife-beating was illegal. The exposure of children was practised to a large extent, and depended entirely on the will of the father. "Among the chief reasons which led to the exposure of a child were deformity, and discord between man and wife; dissatisfaction of the wife's father with the union of which the child was the fruit; persuasion of the wife if her husband got a child by a concubine; superstitions as to evil omens at the time of birth which were thought to indicate coming misfortunes caused by the child, and finally the utter inability of the parents to rear the child on account of their poverty." If the child was to live, a ceremony called *Ausa Vatni*, or water-sprinkling, was performed over it. "In the raising and education of boys most attention was paid to their physical development; both physical and intellectual accomplishments were called *idrottir*. The most important of these were—the skilful handling of all kinds of weapons, riding, swimming, snow-shoe running, rowing, wrestling, working in wood and metal, harp-playing; to which would sometimes be added skill in training and managing dogs, falcons, and hawks for the hunt. Of intellectual accomplishments are mentioned knowledge of runes, laws, the art of poetry—so necessary for the remembrance of the deeds of heroes—eloquence, skill in draughts or checkers, chess, and the use of foreign tongues."

The ancient custom of foster-brotherhood prevailed to a great extent among the early Norse tribes. It did not apply only to those who were brought up together, but frequently existed between men who had previously fought against

each other, and had so tested each other's valour. They were mutually bound by an oath to be unselfish and true, to share the same danger, and avenge the other's death ; and their motto was, "One and the same fate may come over us." As might have been expected from a warlike people, their arms and armour were important factors in their life. The sword, axe, and spear, the coat-of-mail, shield, and helmet were the chief of these. The number of illustrations in this section of the book enables the reader to realise the beauty of workmanship and design in the sword-hilts, belts, scabbards, etc.

From weapons to war-customs and methods of warfare by land and sea is the next step, and thence to a description of the "Norseman at home," his spacious dwellings decorated with carved doorways, tapestried walls and elaborate furniture, the convivial feasts, the dress and ornaments of men and women, occupations and sports, both physical and intellectual. Poetry and music were cultivated in a high degree, and the "scalds," or poets, were highly honoured.

From our own point of view, the concluding chapters of the work, dealing with early Norse colonisation and the discovery of Iceland, Greenland, and America, have a special interest. About the middle of the ninth century, the subjection of the lesser chiefs by King Harald Fairhair induced many of them with their followers to emigrate in search of a new home. To quote from the original :—"Owing to his (Harald Fairhair's) oppression many people fled from the country, and many uninhabited lands were then settled—Jamtaland, Helsingjaland, and the Western lands, Sudreyjar (Hebrides), Dyflinnar Skiri (shire of Dublin in Ireland), Katanes (Caithness) in Scotland, and Hjaltland (the Shetlands), Normandi in Valland, and Fœreyjir (the Faroes). At that time Iceland was discovered." A sea rover named Naddod was the discoverer of Iceland (about 861), followed by Floki and others. Greenland was discovered and settled a century later by a Norwegian chief, Thorwald, and his son, Eirek the Red ; and between 985 and 1011 these enterprising mariners, in the course of their expeditions from the northern coasts, discovered the great continent of America. Ten pages of extracts from the sagas give an almost continuous narrative of their adventures in the five distinct expeditions referred to.

We may say of M. du Chaillu's work that, in conception and execution, it does great credit to his long and laborious study of the subject, and it provides a standard volume which cannot fail to arouse a more general and intelligent interest in the Vikings. His publishers are also to be congratulated on their enterprise and the artistic finish with which the volumes have been produced.

Hindu-Koh: Wanderings and Wild Sport on and beyond the Himalayas. By Major-General Donald Macintyre, V.C. With Illustrations. Edinburgh and London : W. Blackwood and Sons. Pp. xx., 464. *Price* 21*s.*

As a book dealing mainly with sport, this volume must take a high place among works of that class, and its many stirring episodes, full of hardy adventure, are none the less attractive that they relate to a time when weapons of precision were less murderously efficient than they are to-day. The author has all the qualities of the best class of sportsmen : he is a close observer of nature, with a keen eye for natural beauty ; he has a good deal to say about the habits and instincts of the larger Himalayan fauna; and his description of their physical characters is clear and precise. He is in sympathy with the various native races, and, living among them on intimate terms, learned a good deal about their ways and feelings. Traversing, too, as he did in all directions, a wild

and unfrequented region, his narrative gives incidentally an excellent idea of its main features.

Writing in the earlier days of forest conservancy, he alludes to the grievance felt by natives in not being allowed free access for sport, or pasture, to the enclosed tracts, and doubts whether such restrictions are worth the irritation they cause, or even always desirable in the interest of the timber. Such matters have, however, been thoroughly considered since those days, and though a certain degree of irritation still exists, and must continue to do so, there can be no doubt that the services performed by this department are not the least of the benefits we have conferred on the country.

General Macintyre remarks on the small amount of damage done by fires to the full-grown timber; and this same thing is observable in Australian bush fires: he even considers they do good by destroying the white ants, and by consuming the undergrowth, which when rotting is a fruitful source of malaria.

The River Karún: An Opening to British Commerce. By WILLIAM FRANCIS AINSWORTH, Ph.D., F.S.A., F.R.G.S. London: Wm. Allen and Co., 13 Waterloo Place, 1890.

This book is evidently and professedly due to the general desire for information regarding the Karún which was recently awakened by the announcement that that river—the only navigable one in Persia—had been thrown open to the commerce of the world. The work adds comparatively little to what has already been written on the subject; but, as a compilation of articles scattered over the pages of various periodicals not readily accessible to the general reader, it is both opportune and valuable. The sources from which Mr. Ainsworth chiefly derives his information are the articles in the *Journal* of the Royal Geographical Society and other periodicals, by Sir Henry Rawlinson, Sir Henry Layard, Captain Selby, Mr. George Mackenzie, Sir John Bateman-Champain, Sir Robert Murdoch Smith, Major Wells, and Colonel Bell.

The work bears traces of the haste which usually characterises "books of occasion." The proof-sheets have not been revised with the care that is peculiarly necessary where foreign unfamiliar proper names are of constant recurrence. As one instance of the kind of inaccuracy to which we refer, Ispahan, Mohammerah, and Shuster are spoken of in the preface as being in Fars, which of course they are not. In speaking of that province Mr. Ainsworth can perhaps hardly be blamed for adopting the not uncommon European barbarism of *Farsistan* for *Fars*—very much as if for *Italy* we substituted *Italianland*. *Sha'rúd* at page 129 is we presume a somewhat elaborate misprint for *Shahrud*, as *Bakhtians* at page 144 is for *Bakhtiari*. At page 53, 1836 instead of 1856 is given as the date of the Persian war with England.

Apart, however, from these unimportant blemishes, and the somewhat involved style of a good many of the sentences, Mr. Ainsworth's book is a welcome compendium of information on a comparatively unknown region which has lately attracted much attention. The writer takes too sanguine a view of the recent action of Persia regarding the Karún, and he is in error in describing that action as a *treaty* with this country. He not unnaturally assumes that the opening of the Karún to foreign navigation as far up as Ahwaz will be followed by roads or railways thence into the interior. Of these, unfortunately, there is as yet no sign, and it is to be feared that they have been sacrificed to another "concession," that namely for the establishment of the "Imperial Persian Bank." Banks and other financial agencies are all very well in their way, but they are of very minor importance compared with improved means of communication.

A Visit to the Azores; with a Chapter on Madeira. By Mrs. Charles Roundell. Pp. 197. London: Bickers and Son, 1889.

It is quite the fashion nowadays for ladies to give to the public, on their return from a visit to out-of-the-way places, a diary of their travels. No attempt is ever made to summarise the results of their experiences; perhaps, if it were, it would be difficult to fill a volume. But even the trivial experiences of travel, if presented by them in such a form as to convey to the reader some idea of the difficulties or conveniences of the journey, would serve a useful purpose to those who might wish to follow in their footsteps: as a rule, it is quite impossible to gather from the majority of these diaries of travel any connected idea of a country: interspersed between the itineraries are reflections on this and that, tit-bits of general information, and quotations innumerable. Mrs. Charles Roundell presents no exception to this style of writing, though she endeavours to retrieve her faults by a better constructed chapter on Madeira, and a useful chapter on the botany and natural history of the Azores. She has been at some pains to read up her subject, and the information she gives is modestly written. The illustrations, too, are excellent. The map, being from the Admiralty chart, is good. On the whole, Mrs. Roundell's book is above the average of ladies' books of travel, and deserves our commendation for the effort she has made to make it instructive as well as entertaining and useful.

H. M. Stanley, the African Explorer. By Arthur Montefiore, F.R.G.S. London: S. W. Partridge and Co., n.d. Pp. 160. *Price* 1*s.* 6*d.*

The book before us gives a brief but very readable account of Mr. H. M. Stanley, from his birth at Denbigh in 1840, until his arrival at Bonalya on the 17th of August 1888. We are informed that Mr. Stanley's baptismal name is John Rollant, now spelt Rolands; a sketch of his early life is given, but we have no means of testing its accuracy.

We have taken some trouble to examine the accounts of Stanley's African exploits given in this book, and find them to be accurate and well balanced. The author rarely falls into such mistakes as one we find on page 147, where, in speaking of Emin Pasha, he says that in 1886 Dr. Junker, the well-known traveller, reached Wadelai, bearing letters and newspapers for the beleaguered Pasha, the first he had received for three years. The portrait of Mr. Stanley, which forms the frontispiece, is a remarkably good one, but the map is wretched. The author has acknowledged his obligations to Mr. Stanley's own works, but we think a line or two might have been spared to acknowledge the sources of his other information and of his illustrations.

One Man's Power: The Life and Work of Emin Pasha in Equatorial Africa. By the Rev. Henry W. Little, Author of *Madagascar: its History and People; How to save Egypt*, etc., etc., etc. With Portrait and Map. London: J. S. Virtue and Co., 1889. Pp. 112.

Rarely has so great and inspiring a topic as the life-work of a man of Emin's prominence received more inadequate treatment. Mr. Little evinces imperfect knowledge of his subject. His book apparently comprises newspaper cuttings hastily pieced together, and dealing for the most part with the Emin Relief Expedition.

Mr. Little should have been more conscientious in his acknowledgments. A large part of the book is plagiarised. The portrait of Emin is one the writer of this notice himself drew from a *description* by Dr. Felkin, and was first published in the *Graphic*, at a time when photographs of him were unobtainable.

Swiss Travel and Swiss Guidebooks. By W. A. B. Coolidge, Editor of *The Alpine Journal.* London: Longmans, Green, and Co., 1889. Pp. 336. *Price* 10*s.* 6*d.*

A curious and interesting volume. The author first attempts "to work out a new side of the history of travel in Switzerland—the development of guidebooks, and other means of travel." He next "traces out the history, mainly from a traveller's point of view, of a well-known Alpine village," viz. Zermatt. The book bears evidence of complete knowledge of the subject, and it is clear that the author has expended much labour upon it. He instances as the "first real Swiss Guidebook" that published in 1684 by J. J. Wagner, the famous Zürich naturalist. In 1793 appeared at Zürich J. G. Ebel's *Anleitung*, which was for about half-a-century *the* Swiss guidebook. Murray's *Handbook* first appeared in 1838, and a few years later (1844) came its great rival *Baedeker*. The latter was first translated into English in 1859. Von Tschudi's guidebook was first published in 1855, and "has been the only really successful rival of *Baedeker*." It has never been translated into English, but the author says: "If I were allowed but one general Swiss guidebook, I would certainly select that of Von Tschudi." He also remarks: "Roughly speaking, I should say that while *Baedeker* is unsurpassed for minute practical details, *Murray* is far superior in the historical, scientific, and Alpine departments, while the references to mountaineering and mountain climbs throughout the last-named book display technical knowledge, so that a prudent traveller wishing to really study the country should provide himself with both."

The Mount Pilatus Railway. By J. Hardmeyer. With 32 Illustrations. Zurich: Orell Füssli and Co., 1889. *Price* 1*s.*

One of the *Illustrated Europe* series, this is a capital little guide to the rival of the Rigi, Mount Pilatus, up which a daring railway has recently been constructed. The information is compact, well selected, and accurate, and the illustrations are good.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Fifth Session, 1888-89.

The Council has the honour to submit the following Annual Report:—

Change of Premises.

In consequence of the rapid growth of the Society's Library and Map Departments, the Rooms now in occupation at 80A Princes Street, Edinburgh, where the accommodation is limited, will be vacated at Whitsunday, 1890. The Council has the gratification to announce that arrangements are being concluded with the Board of Manufactures, by which extensive premises have been secured, including a Lecture Hall, in the new National Portrait Gallery, Queen Street. In meeting the heavy expenses in connection with this change of quarters, apart from an increased annual rental, the Council desires as far as possible to relieve the general funds of the Society by raising a special Removal Fund, to which its members have already contributed. As further donations are required to meet probable expenses, the Council begs to invite contributions from Members of the Society, especially from those resident in Edinburgh, who will derive the greatest benefits from the change.

Membership.

The following is a Statement of the Membership of the Society, as at 31st October, 1889 :—

District.	Membership.
Edinburgh,	646
Glasgow,	239
Dundee,	83
Aberdeen,	54
England, Ireland, India, British Colonies, and Foreign Countries,	138
	1160

Of the above, 119 *are Life-Members.*

The following shows the increase in the Society's Membership during the Session, and the losses by deaths and resignations :—

Membership at 31st October 1888,		1144
Members elected during Session 1888-89,		114
		1258
Deduct Deaths,	16	
„ Resignations,	82	
	—	98
Net Membership, 31st October 1889,		1160

The net increase of Membership during the Session was therefore 16.

Compared with the results of the previous Session : the Edinburgh Membership was increased by 14, the Glasgow Membership was decreased by 1, the Dundee Membership was decreased by 6, the Aberdeen Membership was decreased by 6, the Foreign Membership was increased by 15, and the number of Members who have compounded for Life was increased by 8.

The Honorary Corresponding Members of the Society now number 47, as against 50 at the end of the previous Session : six names were removed from the list, and the following three additional Members were elected, namely—Dr. Johnston-Lavis (Naples), Dr. E. W. Blyden (Monrovia), and M. Rouhier (Marseilles).

The Council is indebted to the Conveners, Honorary Secretaries and Treasurers, and members of the Local Committees in Glasgow, Dundee, and Aberdeen for the services they have rendered in promoting the interests of the Society's Branches.

Diplomas of Fellowship.

Diplomas of Fellowship have been granted by the Council to the following Ordinary Members of the Society, on their application :—His Highness the Sultan of Johor ; the Rev. Thomas Downie ; D. M. Forbes, Esq.; Dato James Meldrum ; Joseph Moore, jun., Esq.; George Macdonald, Esq.; Alexander Waddell, Esq.; George Montagu White, Esq.

Finance.

The Council submits the following Financial Statement :—

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

For the Year ending 31st October 1889.

FUNDS AT THE CLOSE OF LAST ACCOUNT :—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
Balance due by the Bank of Scotland, Edinburgh,		153 19 6	
		£1256 19 3	
Deduct : Due to the Honorary Treasurer,	£9 14 4		
Less : Due by the Secretary,	5 8 1		
		4 6 3	
		£1252 13 0	
ORDINARY SUBSCRIPTIONS :—			
10 Life Members, at £10, 10s.,	£105 0 0		
1 Do. £10, 10s., less £1, 1s. paid last year,	9 9 0		
	£114 9 0		
1 Annual Subscription of £1, 1s., year 1885-86,	1 1 0		
7 Do. do., 1886-87,	7 7 0		
28 Do. do., 1887-88,	29 8 0		
907 Do. do., 1888-89,	952 7 0		
4 Do. do., 1889-90,	4 4 0		
Do. do., 1890-91,	3 3 0		
1 Do. do., 1891-92,	1 1 0		
1 Do. do., 1892-93,	1 1 0		
	£1114 1 0		
Fees received for Society's Diploma,	12 12 0		
SUBSCRIPTIONS towards the Society's Scheme for the Encouragement of Geographical Education,	7 8 6		
SPECIAL SUBSCRIPTION towards the Rankin Exploration Fund,	2 0 0		
PROCEEDS OF LECTURES in Edinburgh, Dundee, Aberdeen, and Glasgow,	40 1 0		
PROCEEDS OF MAGAZINES sold,	45 14 11		
DIVIDENDS and Bank Interest,	44 4 7		
	£1266 2 0		
GRANT received from the Surplus Funds of the Edinburgh International Exhibition, 1886,	95 15 1		
		1361 17 1	
		£2614 10 1	

MAGAZINES, Printing Paper, Lithographing, etc., for Nos. 8 to 12 of Vol. IV., and Nos. 1 to 7 of Vol. V., all inclusive, and for Postage,			£601 14 6
Less : Received during the year for Advertising therein,			60 0 0
			£541 14 6
GENERAL PRINTING,			41 10 0
BOOKS and other Furnishings for Library,			13 1 0
RENTS OF HALLS, and other expenses for Lectures,			162 1 10
RENT OF COUNCIL ROOM, Taxes and Gas, Repairs, Insurance, etc.,			56 3 6
SALARIES :—			
To *Secretary*, year to 10th October 1889,	£250 0 0		
,, *Clerks*, £69 ; Commission, £3, 6s. 6d.,	72 6 6		
		322 6 6	
EXPENSES of Secretary attending Meeting of British Association at Newcastle,			3 10 0
MISCELLANEOUS, including Stationery, Wages to Officer, Porter, Messenger, General Expenses, Advertising, Cleaning, Bank Charges and Postages, and Office Furniture,			122 10 8
EXPENSES connected with the Society's Education Scheme,			7 1 11
			£1269 19 11
FUNDS AT THE CLOSE OF THIS ACCOUNT :			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
Cash in Bank of Scotland, Edinburgh :			
On Deposit Receipt, dated 15th August 1889,	£100 0 0		
On Account Current,	149 17 10		
	£249 17 10		
Deduct—			
Due to the Hon. Treasurer, £9 14 4			
Less—Due by the Secretary, 1 6 11			
	8 7 5		
		241 10 5	
			1344 10 2
			£2614 10 1

Edinburgh, 12th November 1889.—I have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1889, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

JAS. M. MACANDREW, C.A.

Meetings of the Society.

The Society held 20 Meetings during the Session—10 in Edinburgh (including the Annual Business Meeting, and a Special Meeting to hear Dr. Nansen's paper), 6 in Glasgow, 2 in Dundee, and 2 in Aberdeen.

The papers read at these Meetings were contributed by :—Sir W. W. Hunter, who delivered the Anniversary Address, Cope Whitehouse, Esq., Sir Francis de Winton, Sir R. Murdoch Smith, Colonel Cadell, V.C., J. C. Rogers, Esq., Dr. Codrington, Joseph Thomson, Esq., Philip Sewell, Esq., Dr. Hugh R. Mill, Dr. George A. Turner, Henry M. Stanley, Esq. (by letter), Captain Hovgaard, and Dr. Fridtjof Nansen.

Educational Scheme.

A detailed report of the Educational Committee on the Examination held by the Society last session has already been published in the Magazine (vol. v. p. 373 *et seq.*). In accordance with the Resolution intimated in the previous year's report, the examination last session was confined to the same section of the syllabus (Section C) in order that scholars and teachers might have the benefit of the experience afforded by the previous examination. The Council had no hesitation in sanctioning a change, suggested by the Committee, which has had its effect on the results of the year's operations, namely, the exaction of a small fee for each candidate (one shilling for seniors, and sixpence for juniors) in order to make the scheme self-supporting, and thus to relieve the general funds of the Society.

The examination was held on 2d March at six different centres : Edinburgh, Aberdeen, Nairn, Aberlady, Craighead, and Gersa (Caithness). The number of centres was the same as in the previous session; Dundee and Addiewell withdrew from the scheme, but their places were taken by Aberlady and Craighead. For the withdrawal of Dundee an explanation was given which the Committee considered satisfactory : it had reference, not to the nature of the examination, but to the time at which it was held.

The thanks of the Society are specially due to the examiners, Mr. Grant Ogilvie and Mr. William Jolly, to the Convener of the Educational Committee, Mr. Scott Dalgleish, and to the following publishing firms for presenting the Committee with books and atlases as prizes, namely : Messrs. John Bartholomew and Co., Messrs. A. and C. Black, Messrs. Blackie and Son, and Messrs. William Blackwood and Sons.

Scottish Geographical Magazine.

The Council, in approving of the manner in which the Magazine has been conducted, desires to express its recognition of the services rendered by those who have contributed original articles, and of the valuable aid accorded to the Editors by Messrs. J. G. Bartholomew, J. T. Bealby, F. Bosse, George A. Craig, W. Scott Dalgleish, John Geddie, John Gunn, Hugh R. Mill, J. W. M'Crindle, David Patrick, Ralph Richardson, W. A. Taylor, and Coutts Trotter.

Library and Map Departments.

Members of the Society have not, to any great extent, availed themselves of the privilege of borrowing books from the Society's Library, but it is hoped, when the new premises in the National Portrait Gallery have been fitted up, both resident and non-resident members will make greater use of their advantages. A classified catalogue of books in the Library will be prepared and probably published in the course of the next session.

The total additions to the Library during the session numbered 505,—namely, 392 volumes and 113 sets of periodicals. The additions to the Map-Room comprised 7 atlases and 1233 sheets of maps.

The publications of the Intelligence Department of the War Office, of the Marine Survey of India, and of the Hakluyt Society are now received by the Library.

Donations in books, maps and charts, for which the Council desire to record their indebtedness, were received from the Governments of Canada, the Cape of Good Hope, Cyprus, India, Italy, New Zealand, Norway, Switzerland, the United States of America, and Victoria; also from the Hydrographical Department of the Admiralty, and from the Agents-General for New South Wales, New Zealand, Queensland, South Australia, and Victoria, and numerous private donors.

Exploration.

Mr. Daniel J. Rankin, who was commissioned by the Council to carry out explorations in the Zambezi basin, was unfortunately prevented from entering the Interior in consequence of the native and political disturbances in that part of East Africa, but was successful in carrying out a survey of the mouths of the Zambezi, the results of which have been published in the Society's Magazine. Mr. Rankin claims to have discovered in the Chinde River a new and hitherto unexplored mouth of the Zambezi which he considers open to navigation, and less liable to be silted up than the other navigable channels. H.M.S. *Stork*, with Consul Johnston on board, recently navigated this free entrance from the sea into the river Zambezi.

Medal for Explorers.

The Edinburgh International Exhibition Association (1886), out of its surplus funds, granted to the Society a sum of £100 sterling (less charges, £4, 4s. 11d.), for the purpose of founding a Medal for Explorers. The Council, in gratefully acknowledging this grant, hopes to be in a position either to add to the fund, or to allow it to accumulate in order that a Medal for Explorers may be periodically awarded.

For the Council,

ARTHUR SILVA WHITE,
Secretary.

Edinburgh, 1*st November* 1889.

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